THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXXXVIII. No. 2166.] LONDON, NOVEMBER 15, 1904. [56TH YEAR. PRICE 6d.

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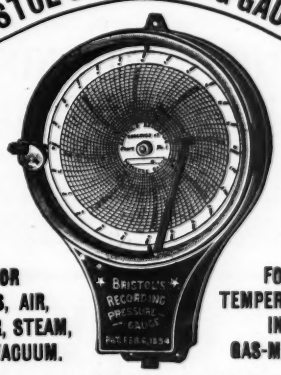

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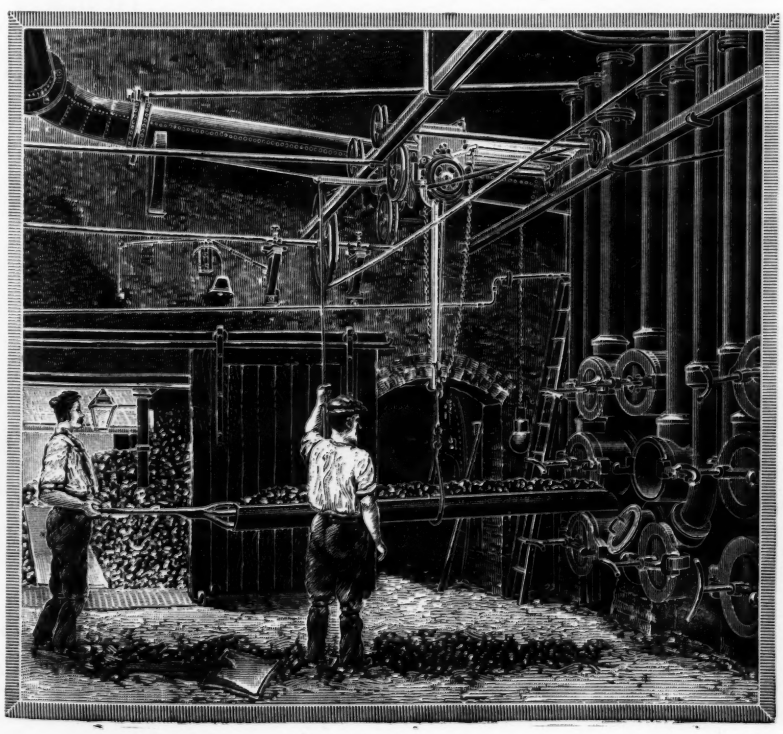

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1000 CANDLE POWER AT 1d. PER HOUR.

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It is particularly adapted for Engineering Works, Foundries, Breweries, Dye Works, Collieries, Brick Works, and all large Shops and Spaces.

Will save 50 per cent. on Lighting Bill where either Electric Light or Gas are in use.

Installations of from 500-Candle Power to any amount can be erected in one to four weeks according to size.

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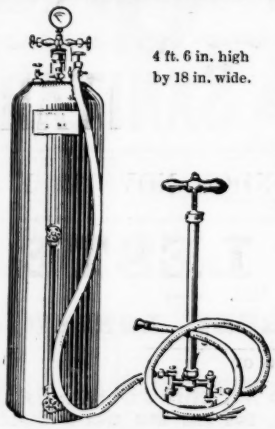

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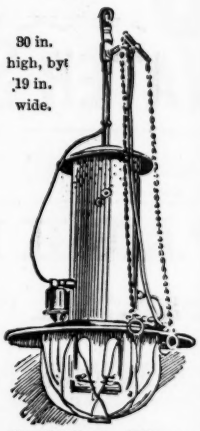

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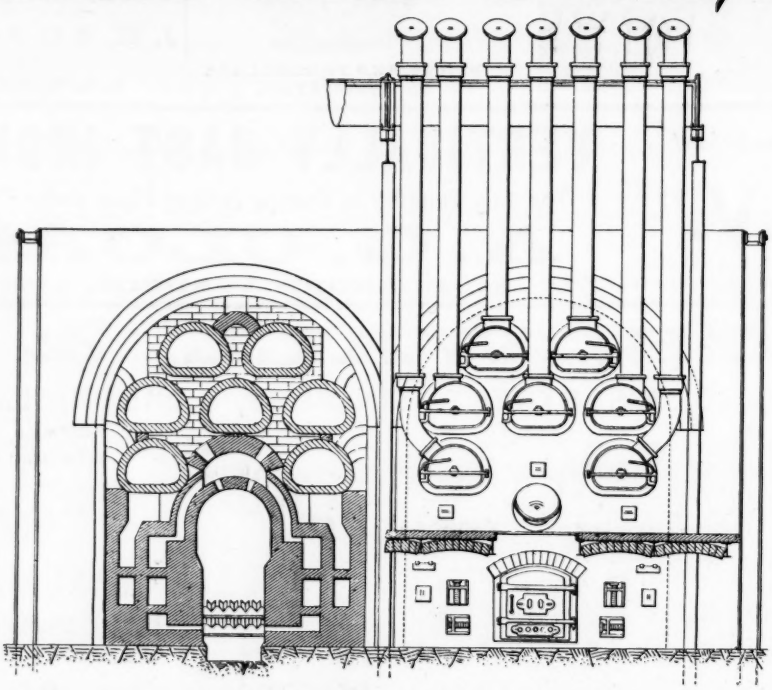

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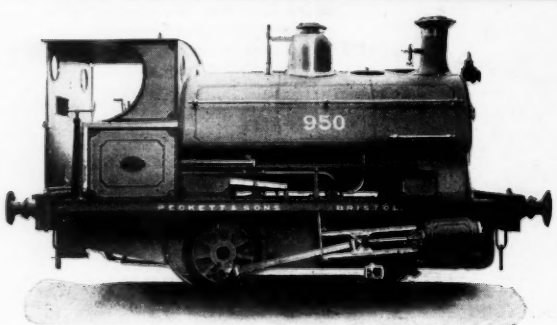

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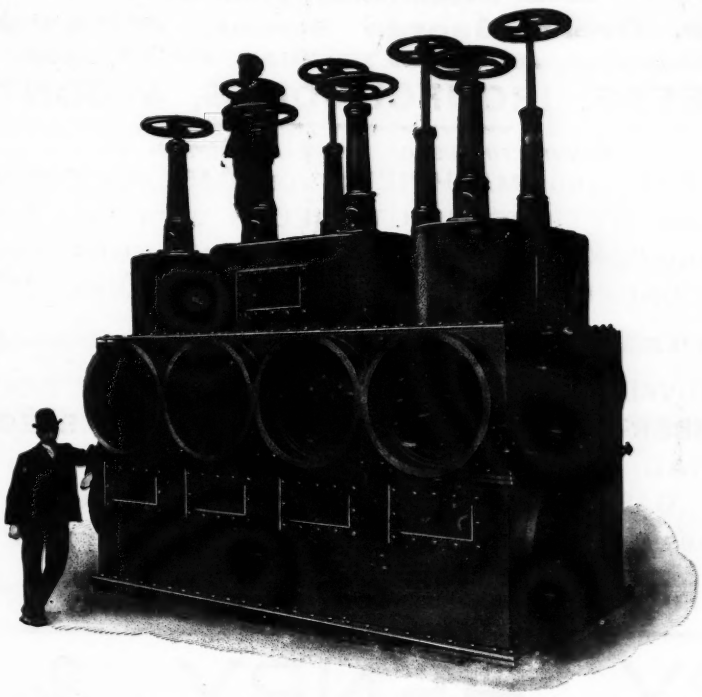

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Fitted with Detachable Attachments.

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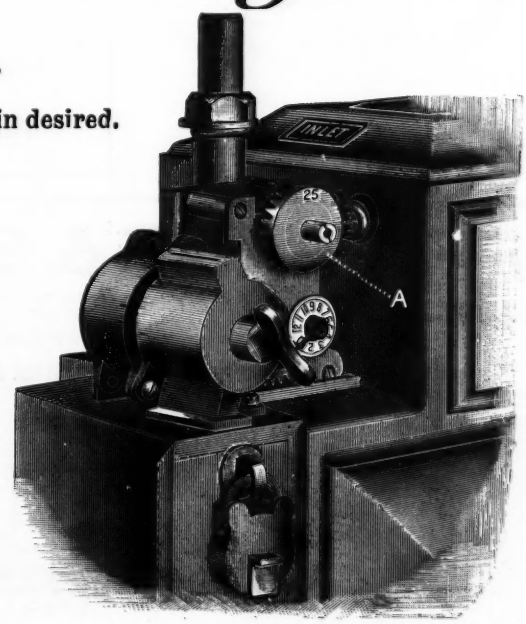

Change of Price effected by simply removing Crown Wheel "A" and replacing same with another Wheel.

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CONDENSERS, SCRUBBERS, AND WASHERS.

PURIFIERS with Planed Joints a Speciality.

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DESIGNS, SPECIFICATIONS, and ESTIMATES FREE.

PIG IRON (SPECIAL QUALITY) for Engine Cylinders. GAS COAL famous for its unrivalled excellence.

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Specialities:
TRANSMISSION OF POWER.
Rope & Belt Pulleys,
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WORKS:
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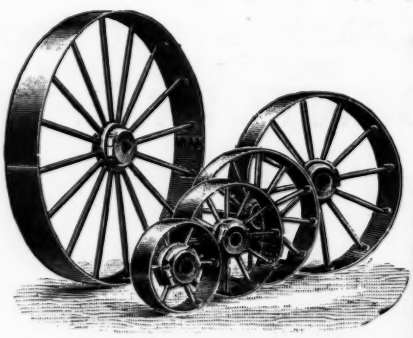

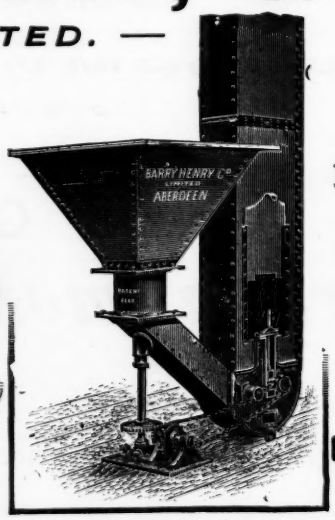

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Fig. 705. "SINGLE RAM" STEAM-PUMP.

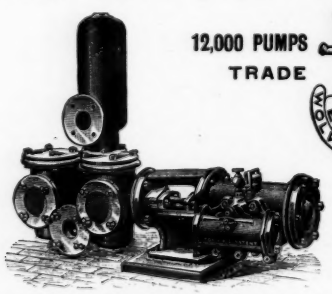

Fig. 598. "CORNISH" STEAM-PUMP FOR BOILER FEEDING, &c.

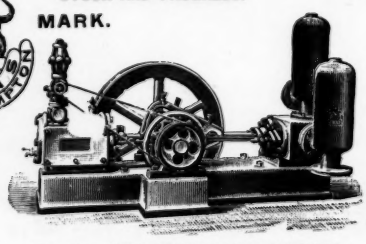

Fig. 685. "RELIABLE" STEAM-PUMP FOR TAR AND THICK FLUIDS.

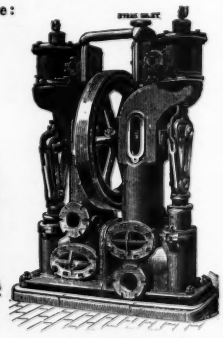

Fig. 712. "DOUBLE-RAM" STEAM-PUMP.

THE THAMES BANK IRON CO.

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SUPPLY FROM STOCK

CAST-IRON RETORTS

AND ALL KINDS OF GAS-WORKS APPARATUS.

SOCKET-PIPES FOR GAS OR WATER PURPOSES.
FLANGE PIPES FOR STEAM.

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DR. ENGELS' PATENT

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An Inverted . . Incandescent Gas-Burner.

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No Soot.

No Lighting Back.

No Discoloration of Fittings.

Best and Cheapest.

ALL PARTS RENEWABLE.

BURNERS, 3s. 9d.
MANTLES, 7s. 6d. and 6s. per dozen.
Special Discounts.

Consumes only 2½ cubic feet of Gas per hour.

75-CANDLE POWER.

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A BRILLIANT WHITE LIGHT.

BURNS BRIGHTER AND LASTS LONGER THAN ANY OTHER MANTLE.

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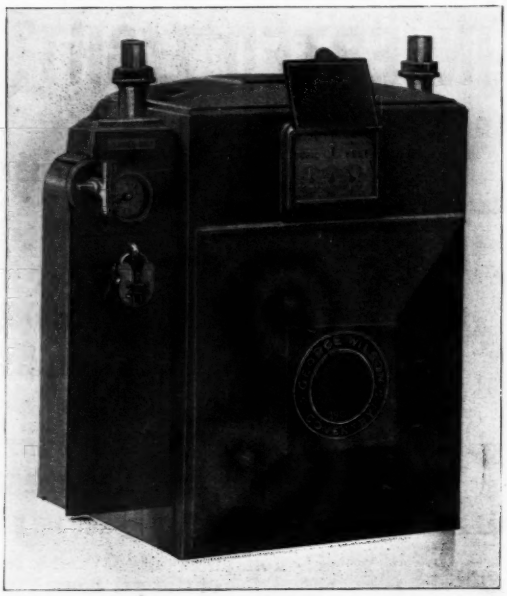

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GAS METER MANUFACTURER,

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Telegrams: "GASMETER, COVENTRY."

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INCANDESCENT GAS LAMP

FOR EXTERIOR LIGHTING.

Patent No. 9747,

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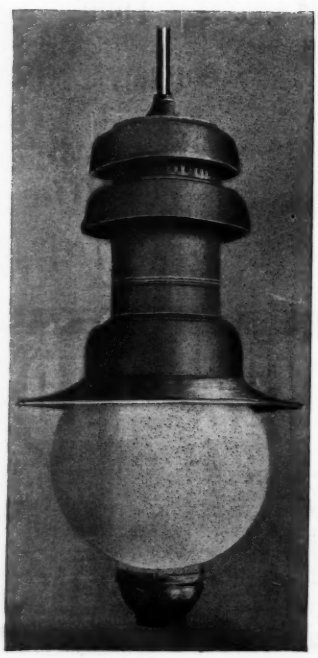
Lamp with Globe up ready for use.



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SPECIALLY RECOMMENDED TO GAS COMPANIES MAINTAINING LAMPS.

English Manufacture.

SOLID COPPER THROUGHOUT.

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Globe lowered, showing wind-proof shield with door open for access to Mantles. Bottom cup can be removed for Globe cleaning.

The Welsbach Kern (Patent)

Self-Intensifying Lamps.

Length overall.
604a 2 ft. 8 in.
604b 3 ft. 3 in.
604c 4 ft. 2 in.

Width overall.
Reflectors.
Enamelled. Opal.
604a 16½ in. 18 in.
604b 22 in. 24 in.
604c 24 in. 26 in.

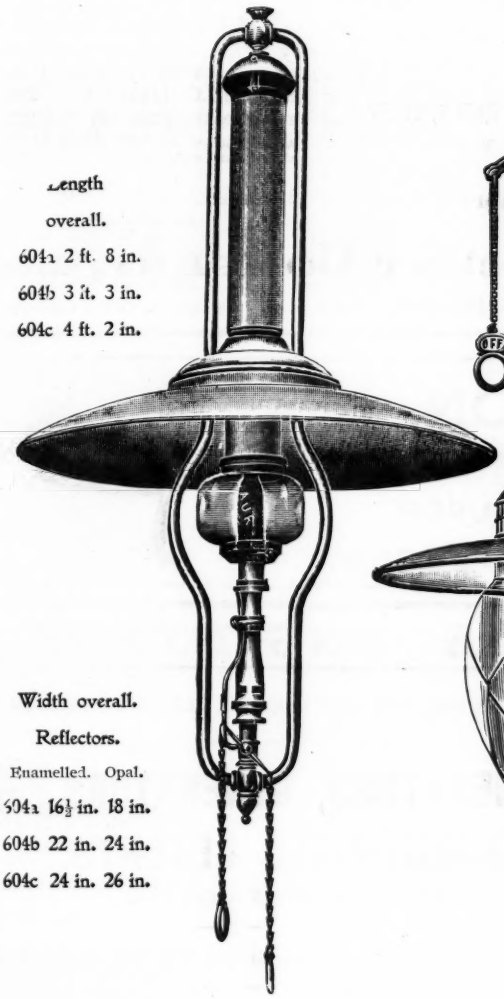

Fig. 604.

Interior Lighting.	Enamelled.
A 5 ft. per hour, 150 c.p.,	£1 13 0
B 10 ft. „ 300 c.p.,	2 8 0
C 20 ft. „ 600 c.p.,	4 4 0

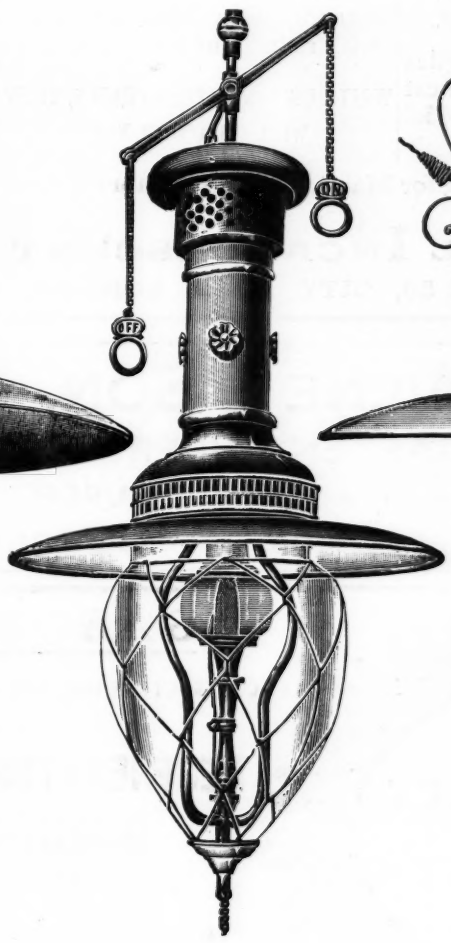

Fig. 607.

Overall.	Length.	Width.
607b	4 ft. 4 in.	24 in.
607c	5 ft. 0 in.	29 in.

Storm Proof Arc. Enamelled Reflector, Cup and Ball Joint, Lever Tap and By-pass.

607b 10 ft. per hour, 300 c p	£5 0 0
607c 20 ft. „ 600 c.p.	7 10 0

Length overall.
Same as sizes 604.

Width overall.
Same as sizes 604.

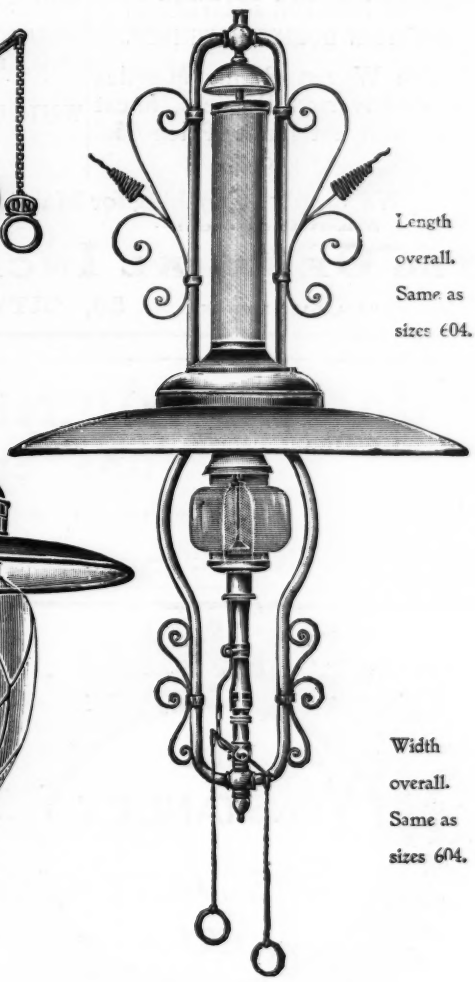

Fig. 605.

Interior Lighting (Ornamental).	
605a 5 ft. per hour, 150 c.p.,	£2 5 0
605b 10 ft. „ 300 c.p.,	3 1 6
605c 20 ft. „ 600 c.p.,	5 0 0

SUBJECT TO OUR USUAL TRADE DISCOUNT.

The Welsbach Incandescent Gas Light Co., Ltd.

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Novelties.
The "Simplon"
INVERTED BURNER
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ORDER NOW FOR DELIVERY IN ROTATION DURING NOVEMBER.

Double Woven Ramie Mantles for all Inverted Burners, finest and strongest made, Price **45s.** per gross.

G.I.C.
Maintenance.
IMPROVED
RAMIE MANTLES
for every known size of Burner.

We are supplying these well-known Maintenance Mantles for "C" and Nos. 2 and 3 Kern Burners, from **26s.** per gross, with reductions for quantities.

WRITE US FOR LATEST PRICES, THEY WILL ASTONISH YOU.

G.I.C.
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	Per Gross.
Clear Domestic Chimneys,	**19s.**
Opal Chimneys	**24s.**
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Opal „ „ .	**26s.**
Opal Combinations . . .	**42s.**

New Polished Brass Outside Air Cone for use with above improves the appearance of Burner and increases the light by 25%. Easily fixed to existing Burners without injury to Mantles, **4/6** per gross. **G.I.C.** Heavy "C" Burner with real steatite ring, **59/-** per gross.

N.B.—All our Glass is about 10% cheaper when taken in original cases, and we pay carriage to your works.

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OF EVERY DESCRIPTION.

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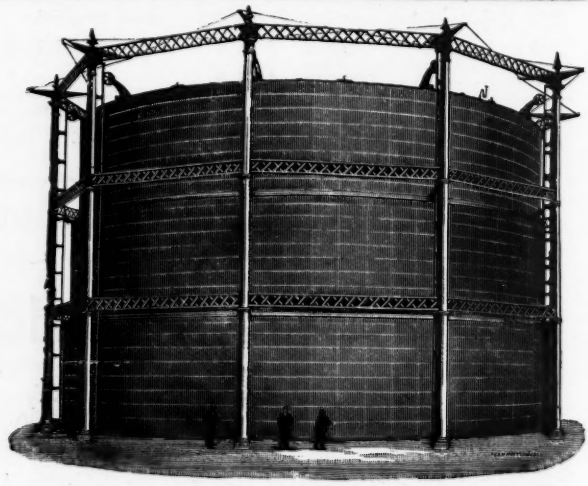

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Cliff's Wortley Aluminous Bricks.

THESE are for Side Walls where great wear and tear takes place. Are made of a specially prepared mixture, are high in Alumina, and are what is termed a HARD FIRE-BRICK.

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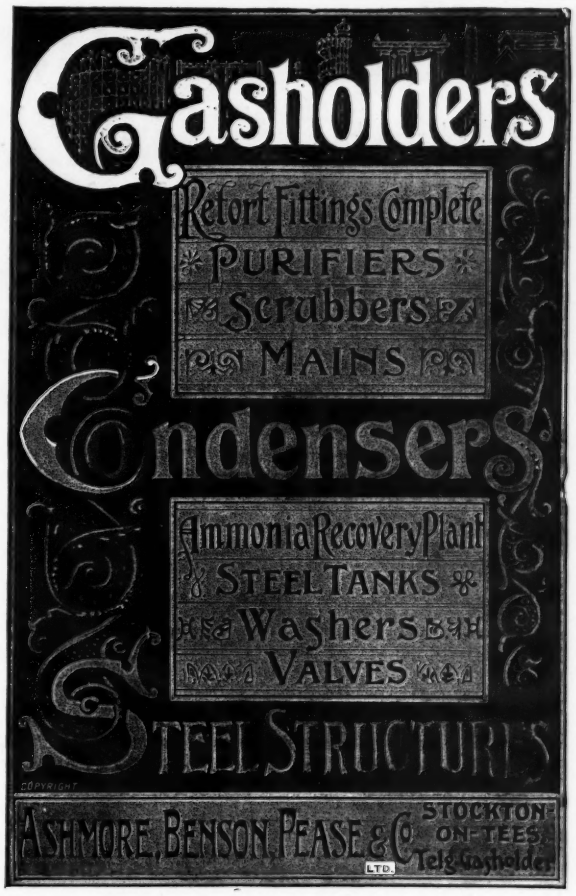

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WOLFF-LIGHT INVERTED LAMP.

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The well-known **CROWN Mantle.**

THE **CILCO Mantle.** New Secret Process.

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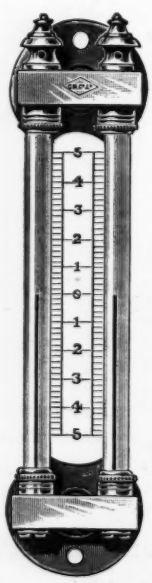

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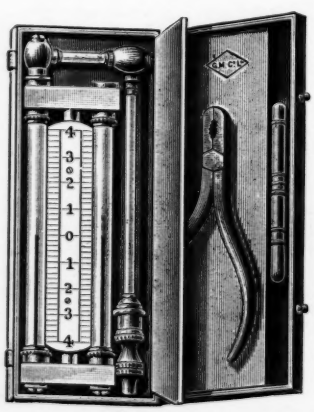

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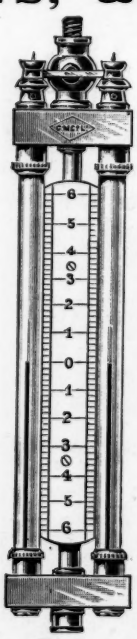

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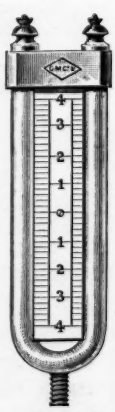

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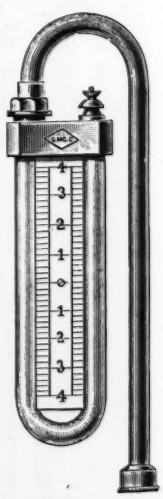

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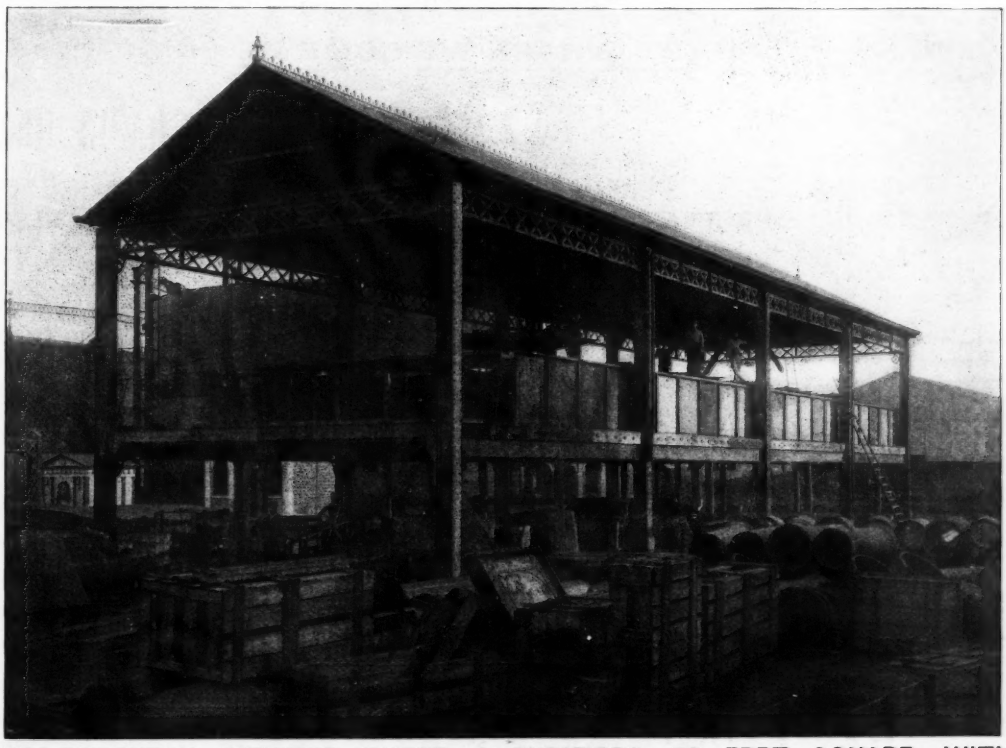

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VOL. LXXXVIII., No. 2166.—TUESDAY, NOVEMBER 15, 1904.

EDITORIAL NOTES—GAS, &c.

Before the Exhibition.

NEXT Saturday the Lord Mayor of London (Alderman John Pound) will open the International Gas Exhibition at Earl's Court. We are emboldened to say, from the knowledge already in our possession, that the history of the gas industry does not contain the equal of what, as a collective demonstration, will be seen at Earl's Court after the 19th inst. While this, it may be heartily granted, is largely due to the personal work and influence—perhaps not of those who originated the idea of an International Gas Exhibition at this particular time, but of those who have carried the idea through, it will be due, to even greater degree, to the magnificent progress which the gas industry has made since the former representative gas exhibition was held. This is not said with any intention of depreciating the work of the Advisory Committee of the Institution or of the Organizing Managers. Upon them, and more especially upon their Chairman (Mr. James W. Helps) has fallen an incalculable amount of detail work; and they have grappled with it with the dogged determination which intends to win success. And success has been won, in bringing together a wealth of demonstration of the power and strength of the gas industry. Altogether there will be between 140 and 150 exhibitors. We have already had some opportunity of judging of the extent and nature of their exhibits; and it may at once be emphatically said that the exhibitors have gone to work with thorough enterprise. Without them, the organizers of the exhibition would have been helpless; and unless the exhibitors had borne the great bulk of the expense of it, there would have been no exhibition at all. We are glad to say these things, and more especially as this event comes so soon after the reconstruction of the principal gas organization. The exhibition is testimony of the most pronounced type that friendship has not been injured, and that those representing the commercial side of the gas industry are as willing to-day as ever to earnestly do their part in any work which has its advancement in view. Such advancement with contractors and manufacturers is of paramount importance, the same as with those more directly concerned in the supply of gas.

The last exhibition of a representative character was that held at the Crystal Palace in the early eighties. Since then, the prepayment meter has been introduced; the incandescent mantle has been brought to a perfection which constitutes it both an offensive and a defensive weapon; and cooking and heating by gas have moved forward with sharp activity. The industry, through these and other things, has prospered as a whole; and all who have portion in that industry have prospered too. The prosperity has meant a great and unprecedented increase in the demand for gas, and the consequent employment of more capital. More capital has meant more work for plant contractors, for manufacturers of appliances for the utilization of gas, and for those engaged in the supply of the commodity. Both in gas-works and outside, in the establishments of those who contract for gas-works supplies, more labour has had to be engaged. The twenty years, too, has been a period in which the necessity for economy has been inculcated and practised. Truly, progress in any branch of industry has not been more marked than in this. What all the change means will be illustrated at Earl's Court during the four weeks from next Saturday, in manufacturing plant and labour-saving appliances, and in the means of utilizing gas to the best advantage, whether for lighting, heating, or cooking. Only those who are able to compare the exhibition held in the early eighties with the exhibits which will fill the large halls at Earl's Court will be in a position to appreciate with completeness the vast changes. Proud was the gas industry of the accomplishment of gas a couple of decades ago; but how much greater are the grounds for elation now!

It is but a natural sequence of the prosperity of the premier commodity of the industry that there should have been a broadening of the field from which supplies are drawn; and among the exhibitors there will be noted not a few who have stepped into, and firmly established themselves in, the industry during the twenty years, and are participating in its prosperity. That is the reward of enterprise, combined with skill, and resolute action when opportunity offered. When the exhibits are being examined, the work that old and new contractors and manufacturers have achieved, both in the inception and the perfecting of gas plant and appliances, will, in an unobtrusive way, thrust itself upon the attention. Contractors and manufacturers are not wearied in the gas industry by any excessive recognition of their work; but there are times when those even most loth to express it must feel what they in public are most frugal in owning. That must be the case with many during their visit to Earl's Court. We should have liked to see a few more contractors and manufacturers exhibiting from abroad, so that some notes could have been compared. It is indeed a matter for regret that, large and good as the exhibition will be, the term "international" will not be better justified than it will be by exhibits from other countries. There has, however, been no want of effort on the part of the Advisory Committee in this regard. Energetically though they have worked throughout, there has not been the response that they had hoped for.

A few words more. What is it that is now wanted to complete the success of the exhibition? The organizers have done their work—and well. The exhibitors are doing their share equally well. The exhibition, as an exemplification of what the gas industry has done and can do, will be, as has been said, incomparable, gauged by any previous effort, or, it may be expected, any other effort in the immediate years. Therefore the opportunity should not be lost by any who are interested in the gas industry in paying it a visit, and in devoting to it as much time as possible; and to exercise their influence in getting, at all events, some representative men of their local governing bodies and consumers to join them in their inspection. It is attendance at the exhibition that is wanted to round off the success. Without it, all the effort, labour, and expense will have been in vain. In this all in the industry can help by a modest expenditure of time and money. In connection with this appeal, we have been asked to repeat that it will greatly assist those who are responsible for the management of the exhibition, besides adding to the general comfort, if those who are organizing parties would communicate, as early as possible, the date of the visit to the Chairman of the Advisory Committee, Mr. J. W. Helps.

Then and Now.

CASTING the mind back in connection with the foregoing reference to the exhibition, tempts us to further reminiscence. It is first worthy of note that history is about to repeat itself in the formal opening of the exhibition next Saturday by the Lord Mayor of London. It is just twenty-two years ago—viz., on Dec. 13, 1882, that the then Lord Mayor of London formally opened the exhibition at the Crystal Palace to which reference has been made. It is true that, on that occasion, electricity was combined with gas; but the similarity of the two occasions will not appear the less obvious on that account. The fact that gas is this time to have an exhibition by itself, and to occupy the very large space which has been devoted to it at Earl's Court, must be regarded as a convincing sign of progress. Indeed, the advance which has been made by the gas industry within the United Kingdom alone, since the date mentioned, is remarkable. The Crystal Palace exhibition is now but little more than a memory, even to those who were engaged in it; and to many it is but a tradition, so great have been the changes in the *personnel* of the gas engineering profession during the interval which has elapsed since it was held.

The reason, however, for which that exhibition was promoted is well known. Only a year or two before, the inventions of Swan and Edison had created a scare in the gas industry, and had very seriously depreciated the value of

all gas property; while in the previous year, there had been an electrical exhibition at the Crystal Palace which excited the minds of speculators, and caused large numbers of the public to believe seriously that the days of gas lighting were numbered. When, therefore, the Crystal Palace Authorities announced their intention of holding an International Electric and Gas Exhibition, and invited the co-operation of the then Gas Institute with regard to the latter, the invitation was at once responded to. A large and influential Committee was formed, with an Executive Committee having Mr. (now Sir) George Livesey as Chairman. Of this Executive Committee, it may be noted, in passing, that the name of only one—that of Mr. Charles Hunt—appears on the Advisory Committee of the present Exhibition. An appeal was made for funds which was liberally responded to; a guarantee fund of upwards of £6000 being subscribed, and a considerable portion of this, it may be stated, was spent. The result was a display of high-power lighting which reassured the timid, and effectually disposed, for the time being, of the claims of electricity to hold the field as the best lighting medium for large areas. At the same time, it materially strengthened the position of gas as a heating agent. Under the auspices of the Executive Committee, exhaustive experiments with cooking and heating stoves were made by the late Mr. D. K. Clark; while the lighting and other exhibits were examined and reported upon by Mr. W. J. Dibdin and the late Professor Foster. It is not too much to say that the labours of these gentlemen have proved to be of the highest value, and have greatly contributed to the progress that has since been made in the applications of gas to which they related. Two notable exhibits deserve special mention even at this distance of time—namely, the Clamond and the Lewis incandescent burners—the forerunners of the present system of incandescent gas lighting.

Will the coming exhibition give us in like manner some indication of what the future may bring forth? In the records of the exhibition twenty-two years ago, no mention is made of the gas-engine, which was then in its infancy, and has since become a giant force. Nor was the prepayment meter then in existence. In its competition with the electric light, gas had then to rely upon illuminating power as developed by means of flat-flame burners, used singly or in groups, or in improved argand burners of high power. Even at such disadvantage, gas could hold its own when given a fair field and no favour; but such was the glamour thrown by electric lighting, that, notwithstanding the success of the exhibition, for some years afterwards it seemed as though the use of gas had been formally relegated to heating, cooking, and motive power. Then with the introduction of incandescent gas lighting, came the revival; gas-engines also came more and more into favour; and the prepayment meter brought the use of gas within the reach of the smallest consumer. For an industry that was said twenty or twenty-five years ago to be threatened with extinction, the following figures taken from the Board of Trade Returns show most remarkable vitality:—

Year.	Total Number of Consumers.	Total Gas Sold. Cubic Feet.
1882	1,971,971 ..	66,613,943,898
1902	4,168,725 ..	147,732,584,030

The increase in the twenty years is 111 per cent. in the number of consumers, and 121 per cent. in the quantity of gas sold.

That there exists the same pressing necessity for the present exhibition as for the previous one is not held by any one. It was at that time almost a matter of life and death; whereas now it is rather a question of bringing to a focus, as it were, all that has been done during recent years, by which has been gained for gas its present high position, and to assert its claim for a still larger share of the favour of the public. Our closing remark before the opening of the exhibition is the wish that an abundant success may attend it.

Gas Legislation for the Metropolis.

As the time draws nearer for the publication of the notices relating to Bills to be submitted in the next session of Parliament, expectancy grows keener as to what these notices will reveal with regard to the intention of the Metropolitan Gas Companies towards the recommendations of the Departmental Committee of the Board of Trade as to Gas Testing in the Metropolis. That they are not likely to favour the pick-and-choose policy of the London County Council, goes without saying; but whether they will act separately or in unison, is a question which, though often asked, has been difficult—not to say impossible—to answer. Every well-wisher of the gas industry rejoiced at the *rapprochement* which, without disparagement to other important matters, may be said to have formed the distinguishing feature of the last half-yearly meeting of the Gaslight and Coke Company; for this was of hopeful augury, not only as affecting the subject on hand, but also for the future relations of the two leading gas undertakings. There is so much to be gained by co-operation and mutual help, and so much that may be lost by the perpetuation of petty jealousies, that any common ground upon which the representatives of these Companies can meet—any common object which brings them together—links them in an alliance which it is to be hoped may be as enduring as it must prove mutually advantageous, and which would give infinite satisfaction to the friends of both.

The hopes that were engendered by the suggestion which was made at the meeting above referred to, by the Governor of the Company (Sir W. T. Makins, Bart.), that the alternative before the Companies was the promotion by them of a Joint Bill, were not greatly disturbed by the later utterances of Mr. R. G. Bradshaw, who, as Chairman of the Commercial Gas Company, hinted at the possibility of his Company being obliged—apparently by want of agreement with the other Companies—to promote a Bill of their own. It was known that all the Companies desired a conference; and whenever reasonable men meet together, an agreement is always possible, however divergent may be their views at the outset. In this case, there could only be one or two points on which the views of all the parties were not in complete harmony; and that these have been brought into line may with some degree of confidence be anticipated. The sequel will show. It is with great satisfaction that we are able to say this much; and it will also—unless we are very greatly mistaken—be most satisfactory to our readers to know that Sir George Livesey's voice has been heard throughout the negotiations between the Companies, though his bodily presence was not possible at the meetings which have taken place, owing to the long and distressing illness from which he is now happily recovering. All will rejoice to know that he who is so identified with the cause of freedom for gas undertakings has been enabled to participate thus far in this latest blow for freedom. For that the Bill will aim at securing for the Metropolitan Companies a large measure of freedom, is a foregone conclusion. There can be no other reason for its promotion than the striking off of those shackles which have weighed so grievously upon them and upon their officers all these years, and the abolition of the fetish which has been so much the object of adoration at Spring Gardens. What the exact provisions of the Bill are likely to be is, of course, not yet made known; but it may be regarded as certain that no measure which does not secure to the Companies the same amount of freedom as has always been enjoyed by Suburban or the leading Provincial gas undertakings, will, or can, be regarded as satisfactory for any length of time. But the largest measure of liberty for all is what is wanted, and must eventually be granted.

In the last reference to this subject in these columns, mention was made of the fact that the Council of the Institution of Gas Engineers had under consideration the desirability of taking action, by memorial to the Board of Trade or in some other way, with regard to the recommendation of the Departmental Committee as to retention of the 5-foot rate of consumption when testing gas for illuminating power. It is not betraying any secret to say that it has now been decided to submit to the Board of Trade the views upon this subject of the Council, as representing practically the whole of the gas industry, and to lay before them a proposal to adopt (with the "London" argand as the standard burner) a fixed height of flame which, in the opinion of the Council, is suitable for all qualities of gas having an illuminating power of 18 candles or less, and whether made entirely from coal or a mixture of coal and carburetted water gas. It is understood that a memorial to this effect is in course of preparation, if it be not already under consideration by the Council; and we hope to be able in due course to publish what cannot but prove to be an interesting document in many respects, and a highly important one in its bearing upon the present crisis.

The Conclusion of Affiliation.

THE final stage in the scheme of affiliation of the District Associations with the Institution of Gas Engineers is now being entered upon. A special general meeting of the members of the Institution is to be held at Earl's Court, on the 26th inst., for the purpose of passing two resolutions—one summing up the conditions on which affiliation is to take place, and the other making the necessary emendations in the Articles of Association. The alterations to be made are additional and not textual; and, as the principle of affiliation and the terms have been so thoroughly discussed, the proceedings can only be of a formal character. If the resolutions are passed, the second one, providing for the alteration of the Articles, will have to be presented for confirmation at a further meeting; and this will set the seal to the scheme, which we hope marks the beginning of an unbroken unity, girded by amity and oneness in endeavour, in the ranks of the gas profession.

"All's well that ends well;" and this particular scheme, although its value has been slightingly estimated by some, has ended well. It has, indeed, been a signal success; and no small amount of credit for this is due to Mr. Andrew Dougall, the first President of the new Institution, Mr. J. W. Helps, the Hon. Secretary, and the members of the Council generally. We speak of the scheme as being an accomplished fact, though the legal requirements have yet to be met. But there is no fear now of the scheme being crippled; for the affiliating Associations represent the majority in the membership of the Institution. It is indeed a peculiarly gratifying feature of the project that, while there were those who could not see anything more than a little sentimental indefinable something about it, the whole of the Associations (to the number of six), excepting the North British, should have carried the proposal through with not quite, but almost absolute unanimity. The resolutions which will be submitted to the special meeting on the 26th inst. will, through their plainness and definitive character, lay at rest any apprehension as to evil befalling the Associations through the Institution; and, as to affiliation covering some violation, through the Associations, of the first principles upon which the constitution of the new Institution was framed. Nothing can be clearer than the primary condition attaching to the first resolution: "That the name of each District "Association shall be retained, and that the management "and financial arrangements thereof respectively remain "under the control of each such Association." In respect of the second cause of fear, what can be more conclusive than this: "That any member of a District Asso- "ciation not elected to the Institution shall have no claim "to the benefits and privileges of the Institution." It will further be seen that the conditions attaching to the appointment of District Members (for so they are to be known) of the Council are set out in the extension of the Article governing the matter. The appointment of District Members of the Council is to be an annual one. But any eligible member of an Association can be elected and re-elected for, but not more than, three successive years; and he is to have all the rights and privileges of an ordinary member of the Council. In the resolutions, too, will be found provision respecting the election to the Institution, without entrance fee and during twelve months after affiliation, of members of District Associations who are qualified to become members, associate members, and associates of the central body. It may hereafter save trouble if an announcement is made at the special meeting as to when affiliation really commences, so that there may be no dispute as to when the open door for qualified members is closed. It is remarked too that no measures are taken in the resolutions for the prevention of any manager not at present a member of a District Association obtaining, through temporary membership of an Association, a cheap entry to the Institution.

As remarked, this is the final step in bringing the technical organizations of the gas industry of England and Ireland under one recognized head. It must be confessed that it is not possible to perceive any immediate tangible advantage that will proceed from affiliation; but our faith in the ultimate benefits of the unity of the District Associations with the Institution is of the strongest. An alliance of this kind, founded on common interests, all working for the one end of technical advancement, and all contributing their share to the strength which increases with the expansion of numbers, cannot fail to be productive of much good. The Institution will be the stronger through union with the Associations; and the Associations, through their relationship with the Institution, and not only so but with each other. Where several organizations have an independent existence, the more chance is there of further division; but affiliation will give that support and binding influence which will, it is fully believed, ensure stability and permanence. No one interested, the statement may be ventured, can look upon the present position with other feelings than those of contentment. We are among those interested; and, being so, we may heartily congratulate both the Institution and the District Associations upon the work which has been well and wisely done.

The South Suburban Company in the Police Court.

THE proceedings at the Greenwich Police Court on Tuesday last, a report of which appears elsewhere, possess an interest which does not usually attach to the hearing of a summons for deficient illuminating power or purity of gas supply. Such proceedings are ordinarily of a very prosaic character, and attract little public attention. For some reason or other, they are seldom or never heard of in connection with Suburban or Provincial gas undertakings, and may be regarded as a relic of barbarism—doomed, it is to be hoped, to extinction as one of the results of the recent report of the Departmental Committee of the Board of Trade on Gas Testing in the Metropolis. The particular circumstances under which the law was invoked in the present instance are doubtless fresh in the minds of our readers. It will be recollected that the South Suburban Gas Company were last session disappointed in their second endeavour to obtain legislative relief from restrictions which exposed them to prosecutions—on the one hand, for creating a nuisance with foul lime in the fulfilment of their statutory obligations with regard to the removal of sulphur compounds, and, on the other, for pollution of a stream adjoining their works by tarry products resulting from the manufacture of carburetted water gas; such manufacture being necessitated by their having to enrich the gas up to 15 candles illuminating power. They therefore resolved upon a course which, while also involving an infraction of the law as it stands to-day, appeared to them—as it must also appear to every reasonable mind—as the less of two evils. They issued what has already been referred to in these columns as their now famous circular to their consumers, setting forth the difficult position in which they were placed, and the unreasonableness and obstructiveness of the restrictions which had caused it, explaining at the same time the disadvantages which attended the use of carburetted water gas. They therefore announced their intention of abandoning the use both of lime (by which the sulphur compounds, other than sulphuretted hydrogen, would be permitted to pass with the gas to the consumers' burners) and carburetted water gas (by which the illuminating power would be reduced to 14 candles or thereabouts).

The Directors being convinced that these changes would be to the advantage of the consumers, appealed to them to give their proposals a fair trial—adding that the price of gas would be reduced by 1d. per 1000 cubic feet, which would mean £5000 per annum to the consumers, or considerably more than would be saved to the Company by the abolition of enrichment. This reduction, it was stated, would entitle the Company to an additional dividend of 2s. 6d. per cent., which, however, for the next twelve months, it was not intended to pay. The letter concludes by asking: "If, as the "Directors believe, the change will benefit the inhabitants "in the neighbourhood of the gas-works, and will also give "satisfaction to the consumers, will the Local Authorities "give the experiment a fair trial?" An answer to this was afforded last Tuesday, when the Lewisham Borough Council appeared as the prosecuting authority. They had previously proceeded against the Company on the indictments already referred to, and had been actively in opposition to the latter in Parliament, so that they may be said to have been mainly instrumental in creating the position to which the Company have been impelled. They now appeared, not as having any mandate from the consumers, who are perfectly satisfied with what the Company have done, but merely as the instrument to set the law in motion.

The Company, represented by Mr. Horace Avory, K.C., very wisely refrained from setting up any technical objection to the tests, which were made as far back as Aug. 31. It was stated, in fact, that they were not in a position to

dispute their accuracy; and Mr. Avory assisted the Court by waiving any claim to be furnished with the details of them—confining his attention entirely to what the Magistrate described as "mitigation of punishment." With singular clearness and lucidity, he traced the history of the subject, explaining the great change that had taken place in regard to illuminating power since 1893—the year in which the Company's Act was passed prescribing an illuminating power of 15 candles, and quoting effectively from the letter to the consumers, especially in regard to the recommendation of the Board of Trade Committee as to abolition of sulphur restriction. One point he made is particularly suggestive. Referring to the fact that none of the Companies whose districts of supply adjoin that of the South Suburban Company is bound to supply gas of a higher illuminating power than 14 candles, he mentioned that about half the borough of Lewisham is actually being supplied by the South Metropolitan Company with 14-candle gas. Thus, for certain of the streets and roads of the borough, 14-candle gas must be regarded as satisfactory; while for the neighbouring and adjoining streets and roads it must not be so regarded. Could anything more clearly illustrate the illogicality of the position assumed by local authorities in connection with this subject? It may be said that they have no alternative but to enforce obedience to the law. But have they no minds of their own upon the subject, as to what may be best for their constituents, the consumers? Or are they so law or lawyer ridden as to see nothing but what is in the bond? The Magistrate, Mr. Baggallay, expressed his opinion that there was a great deal in what had been said by Mr. Avory in mitigation of penalties; but he added, as was natural, that he was there to administer the law, and fined the Company 40s. on each summons—giving the Council £2 6s. towards their costs—in this way indicating the degree of importance he attached to the case. Thus has been vindicated the outraged majesty of the law; and who, it may be asked, is the better for it?

Young and Glover's Naphthalene Patent.

Of the contributions which Mr. William Young has made to the controversy on naphthalene which has been proceeding in the "Journal," there is perhaps not one which has been perused with greater interest than will be that which is published to-day. It deals, in greater part, with an important question which we conceived it to be to the interest of the gas industry should be raised, and which, in fact, was raised in a recent editorial on the subject. The "Journal" is not the place to discuss, in the first instance, the legal position of patentees; but it was thought, in view of the peculiar position that Messrs. Young and Glover hold, through their patent, in relation to the process of the oil-washing of gas for the removal of naphthalene, that a complete understanding should, if possible, be obtained in regard to the attitude they intended to assume in connection with whatever proprietary rights they possess in connection with that system. Both Mr. Young and his colleagues (Messrs. Samuel and Thomas Glover) have been for many years friends and workers of and in the gas industry; and therefore it was felt that they would not regard it as presumption on our part to suggest that it would be to the general benefit if we could get into closer touch with their private views in the above-mentioned matter. Mr. Young, with his characteristic courtesy, now makes the position of himself and his colleagues abundantly clear.

There is nothing to be gained by beating about the bush. It is plain that Messrs. Young and Glover do think there has been an unfair encroachment upon their rights, without the acknowledgment which is generally regarded as the due, and the just due, of applicable and useful invention. As we have before pointed out, if Messrs. Young and Glover hold the master-patent for this process, then they are undoubtedly entitled to something more tangible than credit in connection with it; and it is because of this that we also tried to get the declaration of Mr. Young emphasized in the "Journal" as to their process compassing what some believe are developments on it, while others are in agreement with Messrs. Young and Glover that they are only applications fully covered by their patent. Of course, that is the legal point; but, at the same time, it does not require a great amount of consideration to see that—*assuming* that Messrs. Young and Glover hold the master-patent for the washing of gas by oil for the elimination of naphthalene, and also *assuming* that Bell, Colson, and others have, through their investigations, found out something that is not compassed by that master-patent, but is an addition to the process as defined by Young and Glover in their specification—then, if the former assumption is correct, even the correctness of the second one should not, and we think would not, deny to Young and Glover "an acknowledgment of their labours in "the form of" (as Mr. Young puts it) "a small lordship "or commuted royalty." These quoted words only accentuate what Mr. Young has just previously said in his article, that the main object of himself and Messrs. Glover in securing a patent for their invention was to have a "legal "document clearly explaining the nature and result of our "labours—entitling us to ask credit for what we had done "in the solution of the naphthalene problem, and, further, "in the event of the results of our labours proving of great "value to the industry of also *asking a share in the resulting* "*economy*."

Now that is the position. We cannot ask Messrs. Young and Glover to speak clearer. In the application of the system of oil washing for the elimination of naphthalene from gas, they expect something, as we have before put it, more tangible than credit. Whether they will take steps to enforce that recognition, or whether those who believe they have systems which are independent of the claim of Messrs. Young and Glover will defend their views, are matters on which the course of events can only throw full light. But no one can have much doubt now as to what course will be taken if necessity compels. It will not be overlooked that the question in its present aspect has only grown out of Mr. Colson's claim to have discovered a grade of solvent for naphthalene which is particularly powerful in its effects. Whether or not that claim has been disposed of is altogether another matter.

The Successful Practice of Engineering.

It has been with considerable pleasure that we have on various occasions referred to the work of Dr. A. C. Humphreys, not only in his capacity of an engineer and a partner in a firm engaged in the manufacture and erection of what has become an indispensable adjunct to the ordinary plant in gas-works, but also as the Principal of an important institution devoted to the training of men for the engineering profession. Since his selection for this position, he has uttered some weighty words on the subject of the training of engineers, and they have been emphasized by Mr. Walter C. Kerr in an address delivered in the summer at the Stevens Institute of Technology, and now, at the request of Dr. Humphreys, printed for private circulation. We allude to the matter here because Mr. Kerr points out what he considers to be the qualities essential for the successful practice of engineering; and it may be useful to call attention to a few of them. He places foremost a general understanding of men, and sympathy with them, as this unables an engineer to use his knowledge and experience with the least friction with others and the best results for his employer. Knowledge, however, will not alone secure these results. It must be employed, as we pointed out in the "Journal" a few weeks ago, in conjunction with the skilled hand; and it is the possessor of it whose co-operation has to be secured. This can best be done by the exercise of tact and the sympathy about which Mr. Kerr speaks. A man holding a position of authority requires from those under him not only service, but conscientious service; and often this will not be secured even for a money consideration. There must be the possession by the officer of the quality which goes to the making of a good general. As Napoleon once said, the men are there; what is wanted is the right kind of man to lead them.

Some Ways to Ensure It.

Knowledge is a good tool, but it is not vital force; and it is the "human-engine and not the knowledge-engine that does the work." Pope warned people of the dangers attending the possession of a "little learning" on a subject; yet, as Mr. Kerr points out, some men can use that little with great effect because their point of view is right, whereas others misapply a large amount of the knowledge they have laboriously acquired. Their knowledge, to again quote Pope, is little better than "learned lumber." The important thing to be aimed at by the young engineer is the doing of things correctly at the outset. "Real power is characterized

by ability to perform right the first time that which a man never did before." An essential to success in engineering as in other technical work is the capacity to express one's ideas clearly. Engineering is so non-literary in character that the correct use of language is too much neglected; leading to the employment of expressions which do not properly convey the thought. "In engineering," says Mr. Kerr, "it is not rhetoric but diction that makes expression clear; and diction is best learned from the dictionary." He advises the young engineer to cultivate his vocabulary, and learn to use words in their right sense, as they will then be understood even by those who have less knowledge than the user. Though Mr. Kerr's remarks were addressed to American student technicians, they are as applicable to young professional men in the Old Country. This is evidenced by a few sentences in the preface to Dr. Clifford Allbutt's recently issued "Notes on the Composition of Scientific Papers," in which he complains that the composition of some of the papers sent up to him as theses for the M.B. and M.D. degrees at Cambridge is such as to "obscure, perplex, and even hide or travesty the sense." The engineer, and especially the young one, should first possess clear ideas on the subject he is going to write or discourse upon, and then take care that the clearness is not obscured by the verbiage in which those ideas are expressed.

Dual Commissions.

There has been some leader writing and correspondence in the "Electrical Review" on the subject of commissions and Christmas boxes in the electrical industry. The subject is not a congenial one; but it is one that our contemporary considers it a duty to treat upon with some prominence. Two years ago the Council of the Institution of Electrical Engineers issued a "code of professional etiquette for consulting engineers;" and it was evidently wanted, strange though it may seem. One of the rules to be observed was this: "No consulting engineer should receive trade or other discount, or surreptitious commissions or allowances, in connection with any work which he superintends." It seems, from what our contemporary says, that the Council of the Institution had ample justification for demanding the observance of this rule. "Commission transactions," it is remarked, "coming under this description there have been; and we have strong reasons for believing there are to-day." But the rule appears to be nothing better than a dead-letter; for apparently it has not had the effect of stamping out the reprehensible practice in the electrical industry—in, happily, it is believed only few cases—of receiving, in addition to the fee from clients, a commission or allowance from contractors. A rule of the kind is no good without an authority strong enough to administer the necessary degradation in the case of those infringing it, and bringing a reputable profession into disgrace. The "Electrical Review" has taken up the subject not because of whisperings that are all too frequent, but because of a letter that has been shown the Editor offering to grant "special confidential terms" to a firm of consulting engineers for any business done in certain machines. It is a pity that the last measure that was drafted to meet such cases, which would have reached not only the recipient but the giver, did not become law. But because it did not, it must not be forgotten that, though the moral aspect of the matter may be treated with contempt, the recipient of secret commission is within reach of the arm of the law. Whatever may have induced the Council of the Institution of Electrical Engineers to lay down the rule cited above, we are pleased that there has been nothing to call for such an indignity being imposed on the consulting engineers of the gas industry. The Christmas-box question is another matter. The practice of distributing gifts generally in the electrical industry at Christmas time seems, from the correspondence, to be as prolific as in the case of the gas industry. The amount spent on such gifts by one electrical firm alone is stated to run well into four figures!

Touting for Professional Work.

We have heard, and are unhappily in possession of evidence, of the solicitation of professional employment in the gas industry; but there has not come to our knowledge anything quite so bad as the story told in the following paragraph which appeared in the "Electrician" last week:—

On Oct. 27 a well-known London consulting electrical engineer visited the town of Whitstable, and attended a special meeting of the Urban District Council in order to give them the benefit of his opinion and estimates on the question of electric lighting. According to reports in the "Kentish Observer" and the "Canterbury Journal," he commenced his address to the Council by pointing out that his visit would not cost the Council a single penny. After complimenting the town on the high-class shops he had seen there, he outlined a scheme for the electric lighting of the town, and suggested that immediate application should be made for a Provisional Order. He replied to questions with regard to procedure, and the relative prices of electricity and gas. He "was sure that he could write to towns he had been connected with, and secure fifty letters from people who had found electricity to be cheaper." Finally, the Chairman, on behalf of the Council, thanked the electrical engineer for his visit, and stated that, if the Council decided to adopt the scheme, he would no doubt hear more from them. We venture to suggest that, although the electrical engineer in question is a Member of the Institution of Electrical Engineers, his line of action, if this report is correct, is contrary to the spirit of the rules for professional etiquette laid down by the Institution. The first of these rules is as follows: "No consulting engineer should solicit employment as consulting engineer verbally, by letter, by agent paid by commission or otherwise, or by any other means."

Professional men in the electrical industry, it will be seen, are having a bad time of it in their technical press just now. The "rules for professional etiquette," which were clearly needed, obviously require some strong penalties attached to them for infliction in the event of known infraction.

The Finances of Sheffield.

Among the chosen heads of our Corporations for the current civic year, the Lord Mayor of Sheffield (Mr. J. Jonas) occupies a prominent place. Born in Germany, he came to England with the idea of securing a position as traveller in his native country for an English firm—in consequence, it is said, of his having come into contact with English travellers who spoke German very imperfectly. Nearly forty years ago, he arrived at the Wicker Station, Sheffield, without knowing a soul in the city. It was, as Mr. Jonas remarked, a long way from the Wicker Station to the Lord Mayor's chair, but has not proved too far for a man of his energy and perseverance. When, in 1870, Mr. Jonas began business for himself as a steel manufacturer, his working staff consisted of a man and a small boy; whereas the number of men now employed by the firm runs into four figures. The words of a man of such proved ability must carry weight with his fellow-townsmen; and therefore they will doubtless derive consolation from the fact that, in returning thanks after his election as Lord Mayor, Mr. Jonas strongly defended the financial position of the city, which during the recent contests has been somewhat vigorously assailed. After frankly confessing that his object in doing so was to improve the credit of Sheffield, "particularly in London," he quoted figures to show that the debt per head of the population at the present time amounted to £19 8s. 8d., to set against which there were assets of £21 19s. 7d., or an excess of assets over debt of £2 10s. 11d. per head. In 1887, prior to the acquisition of the water-works undertaking, the net debt per head of the then population was about £3. There were at that time, however, no tangible assets; whereas now the trading departments—water, tramways, electricity, and markets—represent 62 per cent. of the debt. Mr. Jonas pointed with pride to the present balance of assets over liabilities, and said he thought there were few Corporations whose credit deserved to stand higher than Sheffield's. But it must be remembered that debts remain fixed while assets may fluctuate widely in value from time to time, with the great probability that if ever realization became necessary or desirable it would be just at the moment when only the very lowest price would be obtainable. It is surely the rapid and continual piling up of debt that constitutes the real danger—quite irrespective of the assets there may be to counterbalance it. A man who owes money is in debt, no matter how usefully he may spend what he has borrowed. It is said that in Sheffield the debt per ratepayer is £110, while the assets are about £122. Would these gentlemen feel at ease if the whole of their private property was mortgaged up to so very narrow a margin? On the one hand, there is the certainty of having to pay interest; on the other, the possibility of a falling off in the value of the investment. But to take another point of view. Granting that these figures are correct, and that Sheffield is at the present moment solvent, how does the ratepayer benefit

from the fact that he is £11 17s. 6d. to the good on the placing of assets against liabilities? Are his rates decreasing? Mr. Jonas said nothing on this point; but it would be surprising if Sheffield had not had the same experience as most other places—rapidly rising rates, with not overmuch to show for the increased payments.

The Question of Borrowing.

At Liverpool also, the re-elected Chairman of the Finance Committee (Mr. J. S. Harmood Banner) has been endeavouring to demonstrate the satisfactory monetary position of his city; and in doing so, he remarked that bankers seemed to think municipalities were attempting to compete with them. If, he said, the bankers were going to refuse accommodation to county councils and municipalities, naturally these bodies must look out for themselves. Personally he was against any such thing as municipal banking; for he would never like to be in the position on the Committee of having large sums of money entrusted to his charge at call when he had not the cash in the bank ready to meet them. Still, if the bankers looked askance at municipalities, and would not give them money, they must get it elsewhere, and would have to do it in competition with the banks. He ventured to think, however, that there was no necessity for this, and that when the bankers had plenty of money in their coffers they would not bring forward the excuses they now did. Mr. Banner's objection to municipal banking appears to be a sound one; and, for the sake of those corporations which are already committed to large capital expenditure, it is to be hoped that his opinion of the "sweet reasonableness" of the bankers may prove to be justified—when they have plenty of money. Meantime, however, though Liverpool may find it easy to place loans, in some other directions financial expedients of a competitive nature have been resorted to. Following on the scheme of the Islington Borough Council to borrow money on short mortgages from investors, which was noticed a few weeks ago, the Deptford Borough Council are proposing to adopt the plan of raising small loans on debentures, the minimum amount of each debenture to be £20, for a fixed period of five years; simple interest at the rate of 3½ per cent. per annum to be paid at the end of the term, in addition to the principal sum secured. The Borough Accountant points out that, while some years ago large capitalists provided complete loans, there has been growing up, outside the Metropolis, a system of taking on deposit small sums repayable under six months' notice. This has been an inducement for the smaller capitalist to transfer his savings from banks and other places, with a resultant saving of interest to the local authorities and benefit to the lenders. This, he says, has been a direct departure in municipal finance, as hitherto all sums lent to local authorities have been secured by a mortgage on the rates, while these amounts are simply lent on deposit, no security whatever beyond the deposit note being given. Several authorities have undertaken, however, if the lender desires—as soon as sums aggregating £50 have been deposited by him in multiples of £10—to issue a debenture for £50 in place of the several deposit notes. Metropolitan Borough Councils have power to issue debentures; and as the Deptford Borough Accountant claims that economy will be effected by the adoption of his scheme, it will, in all probability, meet with favour in other quarters.

What Swansea Has to Pay.

A striking example of the evil days upon which municipalities have fallen as regards the procuring of money is furnished by the Swansea Corporation, who have just arranged with the Bank of England for the issue of £400,000 of debentures. These are being issued at par; while the Corporation are to receive £99 2s. 6d. net for each £100. The debentures are redeemable in five years; and the interest is 4 per cent. The sum now being raised will carry the Corporation only so far as January, after which date the bank undertake to accept additional debentures on the same terms. During the past eighteen months, advances have been secured from the bank at an average rate of about 3¾ per cent.; but inasmuch as the Corporation have a heavy overdraft, and the weekly outlay (for which the Cray water scheme is chiefly responsible) requires special arrangements for financing, Swansea had no alternative but to accept the onerous terms mentioned. The palmy days of 2½ per cent. loans seem to be a long way back now; and local authorities are anxiously asking themselves whether they are ever likely to recur. The rise that has recently taken place in gilt-edged securities has no doubt raised hopes that this may be the case; but there is a very long way to go yet before the conditions ruling eight or nine years ago are again experienced. And one of the greatest obstacles to an early return of really favourable borrowing terms will in all probability be the municipalities themselves. As the value of existing securities rises, we may expect to be inundated with fresh corporation loans, which will more or less enable lenders to retain their position of independence. That this will be for the good of ratepayers at large cannot be seriously questioned—at least by those who have duly noted the wholesome check that the recent period of dear money has put upon municipal ambitions. The particular case of Swansea may be a hard one, in view of the hundreds of thousands of pounds that are being spent on the Cray Water-Works (which will take years to become remunerative); but if they themselves have done nothing that could be avoided to bring about the present difficulty in raising money, they must derive what consolation they can from the knowledge that the hard terms to which they have had to submit have been caused, in part at least, by the reckless manner in which other municipalities have been increasing their indebtedness.

Sir George Livesey.—Our readers will, we are sure, be pleased to learn that Sir George Livesey has so far recovered from his recent serious illness as to allow of his undertaking correspondence. Writing to us last Friday, he said: "I wish to thank you and, through your pages, the many friends who have, by letters and otherwise, given warm expression to their feelings of friendship and sympathy during the time I have been laid aside. I include the vote so kindly moved by Sir William Makins, and so heartily adopted by the members of the Gas Companies' Protection Association, of which Mr. Jones, the President, informed me, and to whom I have written a letter of thanks. To all, I now offer my heartfelt thanks; and I can assure them that their kind sympathy has greatly cheered me. I am thankful to say good progress is being made; and I hope in a few weeks to be about again."

Masonic.—Bro. Henry Hill was last Thursday installed W.M. of the Rickmansworth Lodge, No. 2218.

Annals of Coal Mining.—We have received from the Colliery Guardian Company, Limited, the second series of "Annals of Coal Mining and the Coal Trade," by Mr. R. L. Galloway, and hope to notice it at greater length in a future issue of the "JOURNAL."

The Proposed Memorial to the Late Mr. Willey.—As already announced in the "JOURNAL" (*ante*, p. 183), the citizens of Exeter propose to express their appreciation of the late Mr. Henry A. Willey by erecting a memorial to his memory. It has been decided that it shall take the form of a scholarship; and it is the wish of the Committee who have the matter in hand to collect a sum sufficient to produce an annual income of £100—this being the amount which Mr. Willey generously gave as scholarships during his life—so that the ablest boys in the Manual Schools in the city may be able to attend the larger and more advanced schools in such centres as Manchester.

Birthday Honours.—Among the appointments which His Majesty the King has been pleased to make on the occasion of his birthday, we are pleased to notice that Sir Fortescue Flannery, M.P., has been created a baronet; that Knighthoods have been conferred upon Mr. R. M. Beachcroft, Mr. J. A. Bellamy, Dr. Shirley F. Murphy, and Dr. J. Wilson Swan, F.R.S.; and that the Hon. Charles A. Parsons, D.Sc., F.R.S., is one of the new Companions of the Bath (Civil Division). Readers of the "JOURNAL" will remember the name of the new baronet in connection with the meetings of the South Suburban Gas Company, of which he is a Director. He is by profession a civil engineer, and has represented the Shipley Division of Yorkshire since 1895. Among the new knights, Mr. R. M. Beachcroft was returned for North Paddington in the first London County Council, and was subsequently Deputy-Chairman and Vice-Chairman of that body. He is a solicitor, and was selected as the first Chairman of the Metropolitan Water Board. Mr. Bellamy is the Chairman of the Plymouth and Stonehouse Gas Company, and was Mayor of Plymouth in 1901 and 1902. He has been an enthusiastic supporter of the movements in favour of sanitary reform, and the establishment of technical schools. Dr. Murphy is the Medical Officer of the London County Council; and Dr. Swan the inventor of the electric lamp bearing his name. The new Companion of the Bath mentioned above is a prominent electrician, and proprietor of the electrical and engineering works of Messrs. C. A. Parsons and Co., at Heaton, Newcastle-on-Tyne. He has developed the steam-turbine; and it may be remembered that his firm supplied the one at the Provan Gas-Works, described in the article which appeared in the "JOURNAL" on the 4th ult.

THE GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 483.)

THE Stock Exchange had a joyful recovery last week. The chief improving factor was the relaxation from keen apprehension regarding our relations with Russia. The favourable turn was also aided by the condition of the Money Market and by the general satisfaction felt at the result of the American presidential election. And so the markets were cheerful, prices rose, and business was active, spite of the fact that a heavy fortnightly account was in process of settlement; and the brightness lasted right up to the close. In the Money Market, there was an ample supply to meet all demands, and the position is decidedly easier—so often does the unexpected happen. But discount rates kept fairly steady. Business in the Gas Market was moderately active and very steady; one day being about as busy as another. The general tendency was good; a large number of issues making moderate improvements on their opening figures. In Gaslight and Coke, there was a fair amount of business every day, at prices which ranged from 94 to 95; the last transaction being at the lower figure. The secured issues were quiet and steady; the maximum changing hands mostly at 90, and the preference at 108½ and 109. South Metropolitan opened at 128½; but on Wednesday and Friday it was done at 127¼. Then it rallied; and the last bargain on Saturday was at 128½ again. Commercial was more active; both issues being dealt in at good steady figures. The quotations have been drawn into a 2 per cent. margin, the 3⅓ per cent. stock gaining fractionally by the operation. In the Suburban and Provincial group, British was done twice at 40, and scored an advance. Nothing else was touched except Brighton original, at 211. Tottenham "B," however, and West Ham preference advanced two points; and, in the local Exchange, Liverpool "B" and debenture improved one each. In the Continental Companies, Imperial is drawn in to a 2 per cent., and Union to a 3 per cent. margin quotation. The former was done at 210⅜-11½ *cum. div.* and 206¼-7½ *ex div.* European was still untouched, there being no sellers. Among remoter undertakings, Bombay changed hands once at middle figures, and then went *ex div.* Buenos Ayres marked 11⅜; and the debenture advanced a point without business being done. Cape Town preference was dealt in at 9⅜, and the ordinary shares advanced ¼. Melbourne 5 per cent. bonds improved a point, but were not dealt in. Monte Video marked 10¾ *cum. div.* Oriental was done at 146. The Company meet to-morrow to declare their usual 8 per cent. dividend. In Primitivas, the ordinary shares were dealt in at 5½ and 5 1/16, the preference at 4⅞ or thereabouts, and the debenture at 95. River Plate was active at prices which ranged from 11 7/16 to 11¾; and the quotation advanced. San Paulo was done once at 12¼.

The closing quotations at the end of the week are shown in our stock and share list.

ELECTRIC LIGHTING MEMORANDA.

A Disappointing Presidential Address.—Mr. Robert Hammond and Dublin—Mr. Swinburne's Report on the Cheltenham Trouble.

THE Presidential Address which Mr. Alex. Siemens delivered to the members of the Institution of Electrical Engineers last Thursday night was not in its subject-matter exactly what one might have expected Mr. Siemens to produce for a meeting of specialists. One of our electrical contemporaries was hoping that he would give them "something to talk about, without dividing the profession into two hostile camps." The address, we are afraid, will do neither the one nor the other. There is nothing that is contentious about it unless the Trade Unionists raise an outcry against the President, or the anti-metricists contend with his partiality for the metric system, or someone can find point in his remarks anent the change which will be introduced next January by the new Patent Act. The address, as a matter of fact, is one of those good old-fashioned productions that could be adapted to the circumstances of any literary society or association of industrial managers. But it is not quite what was looked for from the President of the Electrical Engineers; and we are afraid that the electricians who heard did not profit much by what fell from their President's lips, excepting that they have learnt his personal views on the three main subjects into which his address is divided. Mr. Siemens's discussion of the three principal factors upon which the working of every industry depends—viz., the capital which provides the works and the raw material, the workman who converts the raw material into the finished product, and the management—may be passed over, as his views, excepting perhaps on one or two incidental points, are in general agreement with educated opinion. As to his preference for the metrical system, his contentions are drawn from the old stock; but on the question of the new Patent Act, he regards it as a fallacy to suppose that a preliminary examination, as practised in the United States, is of any advantage to an inventor. The expensiveness, in his opinion, is against it; and even a favourable result is no guarantee of the validity of the patent. But—Mr. Siemens does not particularly consider this—the first expense may save much more, in view of the fact that anticipations are frequently detected by examination and search. It is all very well to say that it is the business of the inventor to find out for himself what has been done before. This is true to the extent that it is reasonably possible. But there is much that has been done that is only to be found in the archives of the Patent Office and British Museum; and time and opportunity may both be against the inventor personally carrying his search beyond the general channels of information and away into the dark recesses of the institutions named. We admit the liberal education of such a search; but it might pay the busy man to fee someone else to do the work and save his own time.

Mr. Robert Hammond, over the Dublin matter, regards himself as a much maligned and misunderstood person. His estimates are spoken of by his critics as unreliable, and far too optimistic; and his prediction of 1½d. per unit as the cost of generating and delivering electrical energy in Dublin, exclusive of capital charges, is simply derided. For no concealed reason, but simply for the purpose of showing to the world that he has a confidence in himself which few people in Dublin seem to possess, he made his famous offers to take over the management of the undertaking on terms. The first was the proposal to supervise the undertaking during a period of seven years, guaranteeing the above-named cost of 1½d. per unit, and taking for his remuneration the difference between 1½d. per unit and the lowest figure at which he may be able to generate and distribute. That was the first card played by the self-sacrificing Mr. Hammond. The second was produced in his evidence at the recent inquiry, when he told the Inspector that an increase in the output above his former estimate could be generated and distributed at a lower cost still; and, following this up, he offers to undertake the supervision of the undertaking for seven years, and to guarantee the Corporation the lower prices for the increased consumption, which make the average 1·375d. per unit. Of course, it will be understood that these offers have nothing to do with the provision of capital and the capital charges, which charges represent 2½d. on every unit sold; and each £50,000 additional capital expended on the undertaking means an extra sum per unit varying from ¼d. to ½d. according to the output—ignoring altogether the question of depreciation or renewals. The third card is the offer to take over the entire working of the undertaking for a period of not less than fourteen years, on the basis of relieving the city of the capital charges during those years; but, of course, leaving the city to find new capital.

There are two lights in which these offers can be, and are, regarded. They are: First as an answer to critics of the scheme Mr. Hammond has carried out in Dublin, and which is looked upon as an unduly burdensome one; and, secondly, that Mr. Hammond is of opinion that he is better capable of managing the affairs of the Dublin electricity undertaking than the Corporation's permanent officials and Committee. Of course, these gentlemen are of a different opinion. In fact, the Chairman of the Lighting Committee (Mr. Irwin), when the matter came before the City Council last week, did not at all mince his words when he criticized Mr. Hammond's management of the concern, and what is thought to be his want of foresight in safeguarding the interests of the Corporation in relation to the pressure of the coming winter's demands. More scathing comment can surely never have been passed on proposals emanating from a consulting engineer than this, extracted verbatim from Mr. Irwin's speech: "Speaking for myself, I believe that Mr. Hammond's offers are not the proposals of a man who seeks to carry through an ordinary business transaction; and I say deliberately that, in their present form, they are not at all what they seem. Mr. Hammond has stated on oath that they are, in effect, put forward mainly as evidence of his confidence in the design and execution of his scheme; and I think he might also have added, to serve as material in any future controversy between himself and the Corporation respecting such matters as the excessive capital expenditure incurred, the condition of the plant, and the manner in which he has carried out his duties as Consulting Engineer." It was expected that there would have been a rousing debate over the offers at this meeting, but the matter was merely referred to a Committee of the Whole House for consideration. However, the Dublin electricity undertaking will not be managed from the London office of Mr. Hammond if the Lighting Committee prevail in the matter; but in a section of the community of Dublin, there is now an impression that Mr. Hammond, in a burst of great benevolence, is prepared to relieve them of all further anxiety, risk, and responsibility. This opens up a pleasant vista for some, among whom there are no doubt many who would gladly give Mr. Hammond the concern if they were not to be troubled any more over it.

As was expected would be the case, Mr. James Swinburne, who was appointed to investigate the affairs of the Cheltenham Corporation Electricity Department, as the outcome of the charges of mismanagement, has presented a report clear of fear or favour. He has fully appreciated his judicial position, and has acted accordingly—the result being that he has been convinced that there is justification for the charges levelled against the past administration of the department. The report, in fact, supplies some unpleasant reading for those responsible for the latter. There is really for them only one piece of comfort; and it is that their prodigality and want of success has been contributed to in

small part by the fact that Cheltenham is spread over a large area in proportion to its population. But we do not forget that this drawback must apply to other services, and that the Cheltenham Gas Company have, notwithstanding, been remarkably successful. There is in the report a little straight talk on the subject of finances which many other municipalities might with advantage digest. Mr. Swinburne insists that depreciation should be charged in the case of a municipal undertaking, but that, other things being equal, it should be less than the depreciation in the case of a private concern by the amount of the repayment. Of course, in practice, this is much more complicated in the case of local authorities by the borrowing of more money before the original loan is paid off for necessary extensions of plant, &c. The obvious way, however, of keeping matters straight is, in Mr. Swinburne's opinion, to pay off the first loan when taking up the second. But this method is not the one adopted; and so the capital accounts of municipal concerns become a tangle of loans redeemable at different dates, at all sorts of rates of interest, and having no traceable relation to the plant actually in existence. At Cheltenham, plant has been discarded; and the result is that the sinking fund is partly for the purpose of paying off loans whose corresponding plant has no existence. The real state is thus worse than the accounts alone can show—true, only to a small extent. Certain lucid suggestions as to the keeping of accounts are made by Mr. Swinburne, one of the principal of which is that a depreciation and antiquation fund on the present value of the plant, &c., should be charged at a percentage rate that would be charged in private concerns, less the percentage rate for the sinking fund, repairs, and other maintenance charges to come out of the fund.

Going farther into the report of the investigator, it is seen that the administrators of the Cheltenham electricity undertaking have been afflicted, like so many of their contemporaries, with distorted vision. "The main cause," writes Mr. Swinburne, "of the present position of the undertaking, is that it has been managed too much with a view to a rosy future than a matter-of-fact present." "A matter-of-fact present" is excellent; but it is certainly not a factor that has any great weight in the conduct of municipal electricity supplies. In this case mains have been extended in a manner which points to a complete absence of consideration of their really probable revenue. Expensive outlying consumers appear to have obtained the light on the same terms as those in the compulsory area; and this must have been a source of loss. Then as to public lighting, there were 37 arc lamps in 1898; and these have been increased to no less than 388 in the present year. A town of 50,000 inhabitants can hardly afford, in Mr. Swinburne's view, to spend the £6698 allocated to public lighting in the accounts of 1903-4, to say nothing of the larger sum of £8610 necessary to make the undertaking pay expenses! Beyond this, he considers that energy is supplied to the tramway at a price that is too low. It is clear from this little dip into the report that it was time that a spoke was put into the fast revolving wheel of electrical extravagance at Cheltenham. If the inquiry and Mr. Swinburne's report keep the Council from continuing their aimless flight, those who instigated the former will deserve well at the hands of the ratepayers.

"A Handbook of Chemical Engineering."—We have received from Messrs. Davis Bros., of Blackfriars Street, Manchester, the second edition, in two volumes, of the above-named work, by Mr. George E. Davis, Chemical Engineer, and formerly Inspector under the Alkali Works Regulation Acts. Pending the fuller notice of the book which will be given in an early issue of the "JOURNAL," we may say that the contents have been revised throughout, much extended, and in great part re-written, so as to bring the information up to date.

Licences for Carbide of Calcium.—With reference to the granting of licences for carbide of calcium by local authorities under the Petroleum Acts, it has been represented to the Secretary of State for Home Affairs that the removal of the limitation of quantity to be contained in any one vessel would be of advantage to the trade. He considers that this limitation may safely be removed, inasmuch as, in his opinion, there is no increase of danger in the use of larger vessels either in conveyance or storage, provided that the vessel is strong in proportion to the weight of its contents.

New Mayors.—The list of new Mayors contains, as usual, the names of several gentlemen connected with gas and water supply. Alderman F. Audsley (Ossett) is Chairman of the Gas Committee of the Corporation; Mr. R. E. W. Berrington (Wolverhampton) was trained in the Water Department of the Corporation, and is a member of the British Association of Water-Works Engineers; Mr. C. Fitzroy Doll (Holborn) is a member of the Metropolitan Water Board; Mr. E. Finn (Lydd), elected for the seventeenth time, is Chairman of the Gas Company; Alderman Jackson (Todmorden) is Chairman of the Holyhead and North Wales Gas and Water Corporation; Mr. John Mottram (Stafford) is Chairman of the Water Committee of the Corporation; Mr. C. Tacon (Eye), elected for the tenth time, is Chairman of the Gas Company; Mr. G. F. Thompson (Dudley) is a Director of the Gas Company; Mr. E. Trounson (Southport) is Chairman of the Gas Committee of the Corporation; Mr. C. Witts (Hereford) is a member of the Gas Committee in his city.

THE AFFILIATION QUESTION.

Affiliation bids fair to be shortly completed. There is to be a special general meeting of the members of the Institution of Gas Engineers in the Lecture Hall of the International Gas Exhibition, Earl's Court, on Saturday, Nov. 26, at 11.30 a.m., when the two resolutions printed below will be proposed; and the passing of these will finally clear the way to the completion of the scheme.

1. Resolved that each of the following District Associations—viz., The Eastern Counties Gas Managers' Association, the Irish Association of Gas Managers, the Manchester District Institution of Gas Engineers, the Midland Association of Gas Managers, the North of England Gas Managers' Association, and the Southern District Association of Gas Engineers and Managers, and each of such other similar District Associations as the Council may from time to time resolve to admit as affiliated Associations, be—upon payment of the affiliation fee of Five Guineas below mentioned, and remain so long as it continues to pay the said affiliation fee annually on the date fixed by the Council, or within 30 days thereafter—affiliated and received into union by this Institution upon the following terms:—

(1) That the name of each District Association shall be retained, and that the management and financial arrangements thereof respectively remain under the control of each such Association.

(2) That any member of a District Association not elected to the Institution shall have no claim to the benefits and privileges of the Institution.

(3) That each District Association shall elect annually a member of its body who is a member of the Institution of Gas Engineers who shall become a District Member of the Council of the Institution, and that each District Association shall pay annually an affiliation fee of five guineas.

(4) That members of each District Association (who are qualified to become members, associate members, or associates under the Articles of Association of the Institution) shall be eligible for election to the Institution without entrance fee during the period of twelve months after affiliation.

(5) Either the Institution or any Association which has paid the affiliation fee for the current year may terminate the relations caused by affiliation by giving to the other of them six months' previous notice, in writing, expiring on the 31st day of December in any year. On the expiration of such notice, such Association shall cease to be affiliated to the Institution.

2. Resolved that the Articles of Association be altered in manner following:—

(*a*) The following clause shall be inserted at the end of Article 12—namely, "Members of any affiliated District Association who are qualified to become members, associate members, or associates of the Institution shall be eligible for election to the Institution without entrance fee during a period of twelve months after affiliation."

(*b*) The following Articles shall be inserted after Article 44—viz., 44*a*. The Council shall, in addition to the other members of the Council hereinafter provided for, consist of the persons who shall be appointed by affiliated District Associations under, and shall hold office subject to, the provisions hereinafter contained, namely:—

(*a*) Members of the Council appointed under the provisions of this clause shall be called District Members of the Council.

(*b*) Each affiliated District Association shall be entitled upon affiliation to nominate one member of its body who is a member of the Institution to be a District Member of the Council, and shall signify, in manner hereinafter provided, such nomination to the Secretary of the Institution; and the person so nominated shall thereupon become a Member of the Council as if he were appointed by the Articles, and shall hold office until the annual general meeting next after its affiliation.

(*c*) At any time not later than 60 days prior to the date of each annual general meeting held while it continues affiliated, each affiliated District Association shall be entitled to nominate one member of its body who is a member of the Institution to be a District Member of the Council, and shall signify as aforesaid such nomination to the Secretary of the Institution; and the person so appointed shall, as from the close of such next ensuing annual general meeting, become a member of the Council as if he had been appointed by the Articles, and shall hold office until the close of the annual general meeting held in the year after his appointment. Any person appointed a District Member of Council as aforesaid shall be eligible for re-appointment as such in each successive year, but shall not hold such office for more than three successive years.

(*d*) A District Member of Council shall have all the rights, privileges, and powers of an ordinary member of Council, but shall be subject to the provisions of Articles 27 and 38, and shall also cease to hold office upon the affiliated District Association which appointed him ceasing to be affiliated to the Institution; but he shall not be subject to the Articles as to retirement by rotation, nor shall he be taken into consideration in the selection of the members who are so to retire.

(*e*) In case of any casual vacancy occurring in the office of District Member of Council, the affiliated District Association which appointed the District Member of Council whose vacation of office has caused a vacancy, shall be entitled to fill up the vacancy in manner aforesaid; and the person so nominated shall hold office until the close of the annual general meeting next following his appointment.

(*f*) Written notice of the nomination of a District Member of Council must forthwith after such nomination is made be sent by registered letter to the Secretary of the Institution, and no nomination under sub-clause (*c*) hereof shall be valid, unless such notice shall reach the Secretary at least 50 days before the holding of the annual general meeting for which such nomination is made.

THE TREND OF CHEMICAL INVENTION.

THE members of the Society of Chemical Industry were treated yesterday week to one of those charming essays for which Mr. J. Fletcher Moulton, K.C., M.P., is famed among technicians and scientists of the country. Few men have the gift of insight on all manners of scientific work and subject that Mr. Moulton possesses; and, when addressing specialists on their own particular themes, he adopts the attitude of the outside but interested observer. But as he proceeds, one can hardly believe that Mr. Moulton is not of his (the listener's) own profession.

In his paper to the Society of Chemical Industry, he referred to the sources of the supply of chemical materials; and in this connection he discussed the possibility of a change in the source of our supplies of combined nitrogen. It was, he said, prophesied by the late Sir Frederick Bramwell that in fifty years steam-engines would be superseded by gas-engines. To realize the presence of ammonia as an available bye-product in the manufacture of gas for such engines, and to work out a practical process which would extract substantially the whole of that which is present in the waste products of combustion in such manufacture, would be to open out a source of combined nitrogen on the most gigantic scale, increasing with the growth of all our industries, and specially adapting itself to that tendency to concentrate the generation of power which has followed the development of electricity as a distributing agent. This has been the work of Dr. Ludwig Mond, and though, remarked Mr. Moulton, it is too early to speak of results, if the success of his process can be fully established, so that it comes to form a normal part of our motor-plants, a change of wide and far-reaching character may be expected in many branches of chemical industry. Side by side with this endeavour to collect ammonia as a bye-product of the production of motor gas, humble, but still, he thought, successful, efforts were being made to get it from the nitrogenous contents of peat.

The main advance, however, in chemical industry is in the processes used. There is a tendency, or an aim, which is so general that it may fairly be regarded as characteristic of the advance of to-day taken as a whole. It relates to the question of yield. Both in the modifications of existing processes, and in the choice of new processes, the aim is to increase yield by more perfectly producing the conditions that make for it. That very slight variations in the surrounding circumstances of a chemical operation may have very grave consequences in regard to the yield, constitutes the difficulty of the problem. But it also constitutes its hopefulness; for it is clear that the conditions of success are close at hand, and only the skill to secure them is required. In Mr. Moulton's view, the main trend of invention in chemical industry is rendering certain and complete in their action processes formerly unmanageable or unprofitable by reason of the uncertainty of the reactions that actually and locally take place. The realization of the necessity of uniformity of conditions in order to obtain full yield manifests itself not only in the efforts to improve old processes, but also in the choice of new ones; that process is a good one which permits the necessary conditions to be secured at every point and at every moment.

PERSONAL.

At the meeting of the Leeds Town Council last week, a recommendation by the Gas Committee to appoint Mr. R. N. Webb as Manager of the New Wortley Gas-Works was adopted.

The many friends of Mr. JOHN WEST, the Managing Director of the West Gas Improvement Company, Limited, will be pleased to learn that he has been placed on the Commission of the Peace for Manchester.

In accordance with the terms of the charter and bye-laws of the Institute of Secretaries, the Council has been enlarged; and among others who have joined are Mr. FRANK BUSH, the Secretary of the South Metropolitan Gas Company, and Mr. A. B. PILLING, the Clerk of the Metropolitan Water Board.

After many years' service with the Continental Union Gas Company, Mr. F. W. HIMING has resigned the Secretaryship, in which he is succeeded by Mr. W. MARTIN. Mr. Himing was formerly the Company's Chief Accountant and Travelling Inspector; and on the resignation of Mr. H. John in 1887, he was appointed Secretary.

Among the Fellows of the Royal Society who have been recommended by the President and Council for election, at the anniversary meeting on the 30th inst., as members of the governing body for the ensuing year, we are pleased to notice the name of Dr. PERCY F. FRANKLAND, Professor of Chemistry and Metallurgy in the University of Birmingham.

An announcement was made in the "JOURNAL" some months ago that Mr. C. E. BRACKENBURY, Assoc.M.Inst.C.E., had passed the preliminary examination held by the Council of Legal Education; the subject being "Roman Law." We are pleased to find that he satisfied the Examiners in "Constitutional Law and Legal History" at the recent Michaelmas examinations, and passed in the second class. He was a student at the Middle Temple.

At the meeting of the Birmingham City Council on Monday, the 31st ult., the honorary freedom of the city was conferred upon Alderman LAWLEY PARKER, in grateful recognition by the Council of the eminent services rendered by him to the city, and especially of his "unselfish devotion, business ability, and arduous labours as Chairman of the Water Committee during the past eleven years, resulting in the successful completion of the Welsh water scheme."

We heartily congratulate Mr. WILLIAM HARDIE on his election, and the circumstances attending it, as a member of the Tynemouth Town Council on Nov. 1. There were thirty candidates for the fifteen vacancies in the Council; twelve of the vacancies being pursuant upon the town having been recently created a county borough. Mr. Hardie not only headed the poll in the ward he contested—in which ward the gas-works are situated, and in which there were six candidates for three vacancies—but he received more votes than any of the other 29 aspirants for municipal honours.

Six months since Mr. GILBERT LITTLE, M.Inst.Mech.E., was ordered complete rest from business by his medical adviser; and it was imperative that his activity in that respect should cease. Two months' rest, however, put him into a sufficiently satisfactory condition to allow him to proceed on a congenial course of recuperation. An equal length of time was first spent in yachting; and this was succeeded by indulgence for a further two months in Mr. Little's favourite pastime—golfing. His friends will be pleased to learn that he has now returned to Smethwick and business completely restored in health.

At the meeting of the Water Committee of the Manchester Corporation last Thursday, the Engineer, Mr. G. H. HILL, was present, and was congratulated on the successful completion of the second line of pipes in connection with the Thirlmere aqueduct, an account of which is given elsewhere in the "JOURNAL." The Committee unanimously adopted, with great cordiality, the following resolution: "That this Committee desire to express their high appreciation of the admirable manner in which Mr. G. H. Hill, M.Inst.C.E., has carried out the laying of the second line of pipes in connection with the Thirlmere aqueduct, and also their continued confidence in him as adviser in the engineering arrangements in connection with the water supply to the city and district." Mr. Hill thanked the Committee for the confidence they had placed in him, and in touching terms referred to his long service in connection with the water supply to the city—first in association with the late Mr. J. F. Bateman, and subsequently as Engineer to the Committee—his services extending over the past sixty years.

At the invitation of Mr. Richard T. Glover (the Chairman of Messrs. Glover and Main, Limited), a large gathering of employees in all departments of the firm took place on Saturday evening at the Alexandra Palace, to celebrate the coming of age of his second son, Mr. RICHARD B. G. GLOVER. The guests, to the number of about 700 (including several gas managers from places in the neighbourhood), partook of dinner, under the presidency of their host, in the Grand Salon; and the subsequent proceedings were of a very interesting character. The toast of the evening was proposed by Mr. John Glover, who said the gathering was but a replica of one they had previously had; and it afforded another opportunity for employers and employed to meet in social intercourse. On the present occasion, they had assembled to show their good-will to their host, and express their best wishes for his son, who had now attained his majority—or, at all events, would do so in a few days. They were all engaged in a very large concern indeed. This position had been attained only by honest work—by the men in the factory, by the representatives who obtained the orders, and to a certain extent by the management. He spoke of the excellent qualities possessed by his nephew, who would now, he said, have to bear more responsibility in connection with the conduct of the business, which had grown so greatly that last month it reached a record. He concluded by asking the company to drink to the health and prosperity of Mr. Richard Bowie Gaskell Glover, who he hoped might follow in the footsteps of his father. The toast was most enthusiastically honoured. At this point in the proceedings, opportunity was taken for expressing in a more substantial form the sentiments embodied in the toast. This pleasing duty was entrusted to Mr. W. Batt, the representative of the firm in the Midland district, who, in a few felicitous remarks, asked Mr. Glover's acceptance of the gifts he placed before him. They consisted of a beautifully illuminated address in a handsome gilt frame, and also a gold hunter watch, from the workmen, and a gold albert chain and fully fitted travelling-bag from the officials and the travellers—the chain, as Mr. Batt happily expressed it, representing a connecting link between the indoor and outdoor departments. Mr. Glover having suitably acknowledged the toast and the presentations, Mr. James Randall proposed "Messrs. Thomas Glover and Co.," which was responded to by Mr. Kenneth Aird. The other toasts were "The Stewards," acknowledged by Mr. W. Henry; and "The Chairman," proposed by Mr. Maclay. In replying, the Chairman emphasized the point named to by Mr. John Glover earlier in the evening, and stated that, with the co-operation of Messrs. Main, the Company's business, which had originally been confined largely to the South of England, was now extending far into the North. Already they employed 900 hands; and he hoped that it would soon reach 1000. It only remains to say that the entertainment was carried out on a most liberal scale, and that the proceedings throughout were of the heartiest character, being enlivened by vocal and instrumental music.

EXHIBITION NOTES.

THE arrangements have been completed for the opening of the International Gas Exhibition next Saturday. Though the exhibition is promised to be ready for the public at eleven a.m., the official opening by the Lord Mayor will not take place until the evening at half-past five. Alderman John Pound will be formally received at the Warwick Road entrance by the President of the Exhibition, Mr. H. E. Jones (Past-President of the Institution of Gas Engineers), and the Chairman and members of the Advisory Committee. Accompanied by this escort, he will pass between two lines of Army and Navy Reservists (who are employees of various gas companies all over the kingdom) into the exhibition. He will then make an inspection of the exhibits, after which he will be conducted to a däis in the right wing of the Ducal Hall, where the President will make a few remarks. After this, the Chairman of the Advisory Committee of the Exhibition (Mr. J. W. Helps) will explain the objects and scope of the exhibition, Punctually at seven p.m., the party (which will include several notabilities and the Mayors of the various Metropolitan Boroughs, who have been invited to meet the Lord Mayor) will sit down to dinner in the Italian Restaurant close by the emptied lake. The diners are estimated to approach close on 300 in number.

Before the main public entrance in the Warwick Road, there is to be a colossal gas device by the Gaslight and Coke Company. It will measure 40 ft. by 12 ft.; and the consumption of gas is estimated at 15,000 cubic feet per hour. This will be a striking feature.

A correspondent makes the excellent suggestion that gas companies should send tickets of admission to all their shareholders. In view of the fact that only those presented at the doors will have to be paid for, this would not involve the companies in a heavy expense, and it might have the effect of inducing many to attend who would not otherwise do so.

The programme for the meeting of the Southern District Association of Gas Engineers and Managers on Thursday of next week, at the exhibition, shows that for formal business the members will assemble at 11.30 in the morning. The *agenda* only include the confirmation of minutes, the election of President and officers for 1905, and the reception of the report of the Naphthalene Sub-Committee. Lunch will precede the inspection of the exhibits.

From the Hon. Secretary of the Eastern Counties Gas Managers' Association (Mr. T. A. Guyatt) we learn that their visit to the exhibition will be on Dec. 1 and 2. No business will be transacted; it being considered that there will be quite sufficient interest in the exhibition itself to profitably occupy the members. No special arrangements are, therefore, being made, beyond the suggestion as to the dates.

The members of the London and Southern Junior District Association will visit the exhibition on Saturday, Dec. 3.

Additions to the exhibiting firms since our previous list was published are: Messrs. Baer and Co., of Berlin, the Thames Iron-Works, Shipbuilding, and Engineering Company, MM. F. Horowitz and Co., of Paris, Messrs. J. & W. B. Smith, of Farringdon Road, E.C., Mr. D. Anderson, of 4, Berry Street, E.C., Mr. A. Nehemias, of Dunedin House, E.C., Messrs. Simon and Co., of Great Alie Street, E.C., Messrs. Cox and Yeman, of Brompton Road, S.W., Messrs. Howard and Jones, of Cullum Street, E.C., the Pneumatic Gas Lighting Company, of Ironmonger Lane, E.C., Messrs. Stewarts and Lloyds, Ltd., of Glasgow, Messrs. Fenlon and Son, of Tudor Street, E.C., Messrs. Siemens Bros., of Westminster, the Wright and Butler Lamp Manufacturing Company, of Birmingham, Messrs. Quirk, Barton, and Co., of Gracechurch Street, E.C., the Chameleon Signs, Limited, of Dashwood House, E.C.; the Crown Lamp Works, of Chiswell Street, E.C., Messrs. John Barker and Co., Ltd., of Kensington; the Smethurst Furnace and Oil Treatment Syndicate, Ltd., of Great Winchester Street, and Metropolitan Gas Meters, Ltd., of Malt Street, S.E.

The London and Southern District Junior Gas Association have been granted permission to inspect the Poplar works of the Commercial Gas Company on Saturday, the 26th inst. The members will meet on the works at 3.15.

Growing Popularity of Acetylene Lighting in Canada.—The "Municipal Journal and Engineer" (New York), in this month's number, remarks: "Acetylene gas plants for general public lighting are being operated in a number of towns in Ontario. There is an unfounded prejudice against it; but it is gradually dying out. Acetylene gas has the advantage that the pipes conveying it are always dry, will not freeze, and may therefore be laid in very shallow trenches, or even over the surface of the ground. Other advantages of acetylene over ordinary gas are that the former is less poisonous; the cost of constructing and maintaining a plant is less; and the lights do not pollute the air to the same extent as ordinary gas. Unless operated by water-power, few electric plants in small places give an all-day service, whereas gas is always available. In North Bay, the price of 100 feet of acetylene gas (equal, it is estimated, to 1000 feet of coal gas) is $1·53 net."

NAPHTHALENE REMOVAL.

By WILLIAM YOUNG.

In the editorial comments upon my communication which appeared in your issue of the 25th ult., you very kindly gave credit to my colleagues and self for our labours in connection with the naphthalene problem—personally, I feel to an extent much greater than deserved. You further kindly remark that, so far as you know, no one had questioned the validity of the claims for novelty of what is known as the Young and Glover naphthalene process; and you put the question "What does that process compass?" Further, while drawing attention to the main object, you also kindly credit my contribution with having infused into it an interest which brings into relief its educative side in a way that will be helpful to all those who are working in the direction of applying the results of the labours of my colleagues and self, and to those who are pursuing the work with the view of further developments. I have to thank you again for these highly appreciated comments upon the motives prompting my contribution on the subject; they are in full accord with the truth. My labours in connection with the evolution of the solution of the naphthalene problem were labours for the love of the subject, a recreation, a pleasure, and were not undertaken with the object of the pecuniary gain they might possibly bring to me.

The Young and Glover naphthalene process was not, however, the outcome of my labours alone. All that I contributed was that of my past experience and advice. My colleagues, the Messrs. Glover, had all the drudgery and labour connected with making themselves conversant with the principles connected with my life experience. They carried out the drudgery of the experimental work, and the practical application of that work on the practical scale in their own and other works; and I would be very pleased indeed if they, or even I, should be rewarded with something more tangible than that of the credit of being scientific pioneers in the solution of the naphthalene problem. You had evidently entertained somewhat similar views, as is borne out by the gist of your remaining editorial comments; and I wish to refer more particularly to your remark to the following effect: "If the Young and Glover patent covers the Bell, Colson, and any other application of oil washing for the elimination of naphthalene from gas, then it follows that Messrs. Young and Glover are entitled in connection with them to something more tangible than credit." Then, again: "Where patents are concerned, people do not like uncertainty; and a very useful system may suffer in application from doubts in this regard." To avoid such a contingency arising from the cause to which you refer, and also others that have arisen during the correspondence that has taken place on the subject, is my motive for making this further communication bearing upon the matter.

Your pages are not the proper place to discuss the legal aspect of the case; and I will, as far as possible, avoid doing so. It is necessary, however, that I should make some frank explanations regarding the legal document—the specification of the Young and Glover patent. Practically, I am responsible for the matter in the body of the specification descriptive of the process which it claims, as it stands almost as I drafted it, and as it was approved of by my colleagues and our patent agent. Every effort was made as clearly as possible to explain in what the process consisted. The claims may be good or bad; but they were practically left in the hands of the highly-skilled patent agent employed by us. In my former contribution, I also tried to clearly explain, by quotations from the specification, the nature of the Young and Glover process; and the three short quotations to which you referred in your editorial fairly clearly showed what was intended should be claimed. If these claims are wrong, they can be amended; the descriptive matter of the body of the specification could not.

To have a sound conception of whether or not the process described in the Young and Glover patent was novel and whether the claims made were such as to be sound legal ones, it is necessary to have a wide knowledge of previous well-known facts relating to the subject. One of my earliest experiences of the difficulties arising from naphthalene was in connection with the application of the Aitken and Young analyzing or condensing process as applied to the treatment of the gas from Newcastle coals. This process consisted in making the condensed tars to flow backwards over a series of shelves against the flow of gas from the retorts; the lower of these shelves being heated. The object of the process was to remove the tars from contact with the gas as they were deposited, and prevent them dissolving the benzol and other illuminants out of the gas; and the heating of the lower shelves was to revolatilize out of the tar any benzol or other volatile hydrocarbon vapour that the tar might have taken up in solution. The arrangement or process effected its object most effectively—in fact, it acted so well that it not only loaded the gas with all the benzol and other hydrocarbons that would have been left in the tar, but it also loaded it with naphthalene vapours, with the result that the terminal chambers of the arrangement and other mains got blocked up with beautiful white masses of solid crystalline naphthalene.

Attempts were made to restrict the process so as to volatilize the benzol and other light hydrocarbons into the gas without also loading it with naphthalene. But it was found impossible to do so, as the same conditions which allowed the naphthalene

vapours to be retained in solution in the tar also enabled the tar to dissolve out part of the illuminating benzol vapours. The process was thus shown to be unsuited for the treatment of Newcastle coal gas. This was common knowledge nearly thirty years ago. Therefore we knew that coal tar, or rather the hydrocarbons in the coal tar, had a solvent affinity for the hydrocarbon vapours present in coal gas, including those of naphthalene; and this knowledge had since been the guiding principle in all condensing arrangements. The effort has been made in various ways to restrict the solvent affinity of the tar for the benzol and other illuminating vapours of volatile liquids, as far as possible consistent with allowing the tars to absorb the naphthalene—a compromise between the two opposing actions; and under such conditions it is impossible with Newcastle and similar coals to get the tars to remove all the naphthalene from the gas.

The other process of which I had experience about the same time was that alluded to in my former contribution—the washing of shale gases with liquid hydrocarbon solvents to absorb from these gases the vapours of volatile hydrocarbon that could not be reduced to the liquid state by cold in condensers. The process consisted in continually pumping into the top of a scrubbing tower up through which the gas to be scrubbed was passed, a quantity of heavy oil, which, in its passage downwards, absorbed the hydrocarbon vapours from the shale gas. The washing oil, charged with the absorbed vapours, passed to a column still, up through which steam was passed, which distilled out of the heavy oils the vapours which they had absorbed. These vapours, condensed into naphtha, containing hydrocarbons having different boiling points—the most volatile boiling at the temperature of the air, the least volatile considerably above the boiling point of water. By these means we could remove all the vapours from the gas; but in order to do so, it was necessary to use a certain quantity of oil in relation to the gas to be washed. If the quantity fell short of that necessary, the gas passed away still charged with some vapours.

Now I observed—and I have no doubt others have done the same—that, when the supply of oil was short of that needed, it did not continue to take out a proportion of all the vapours present in the shale gas, but the oil absorbed in greater proportion the vapours having the lowest tension; and the resulting recovered naphtha had a higher specific gravity, and the hydrocarbons a higher boiling point. On occasions when the column still had to be temporarily bye-passed, and the oils continued to be circulated through the scrubber, I observed that the heavy oils continued to absorb the least volatile vapours out of the shale gas, and even to continue to do so, and at the same time give up to the gas the more volatile vapours it had previously absorbed.

These facts might be common knowledge—I have no doubt they were—but the only use to which they had been applied prior to the Young and Glover process had been to devise the best means possible to get the smallest quantity of heavy oil to most effectively absorb the whole of the vapours from the gas. It was also common knowledge, at the time of the devising of the Young and Glover patents, that mains and services partially blocked with naphthalene could be cleared by distilling into such mains and services the vapours of volatile liquid hydrocarbons—that these vapours condensing upon the surface of the naphthalene dissolved it so that it flowed to the nearest drip-pot. It was further believed and maintained that the vapours of such hydrocarbons as dissolved naphthalene in the liquid state had also a similar power while diffused through the coal gas as a vapour, and had even the power of adding to the tension of naphthalene vapours and preventing them being deposited out of the gas. We have maintained this view as one of the merits of the Maxim process of carburetting coal gas with benzol, carburine, and similar volatile hydrocarbons, when the main object is to add illuminating power to the gas, and the vapours are never intended to condense into the liquid state. I had long been satisfied that this view was wrong, and on several occasions had drawn attention to evidence that the vapours of volatile hydrocarbons, while diffused through coal gas, had no such effect—that gas enriched with vapours could be passed through a mass of naphthalene crystals without dissolving them in the least, or without the vapours being dissolved out of the gas by the mass of naphthalene, that it was only when the vapours were present in the gas to supersaturation, and passed into the condition of liquid hydrocarbons, that they had any solvent action on naphthalene present in the gas or in the mains and services.

The Botley process of removing naphthalene by introducing into the naphthalene-charged gas a mechanically produced mist or fog of petroleum oil is a capital illustration of a process which was devised under the similar erroneous impression that, by thus mechanically dividing the petroleum into a fog through the gas, there would be conferred upon the naphthalene vapours an increased tension, and enable them, instead of being deposited and giving trouble in the mains and services, to be carried right through to the consumers' burners. At the time this process was brought under the notice of the gas industry, I took the opportunity, by means of correspondence which appeared in your pages, to show that, while the process might have the effect of preventing difficulties, it would not do so because of the oil fog raising the vapour tension of the naphthalene, but by the reverse action of the finely-divided liquid oil particles constituting the fog reducing the vapour tension of the naphthalene and absorbing and dissolving it; that while the process had been designed upon erroneous ideas or beliefs as to the laws of vapour tensions, it might yet succeed in its object, because it (unconsciously to the designers) embodied the conditions necessary to success, inasmuch, as shown at the time, it enabled the oil vapours to absorb the naphthalene out of the gas, or dissolved the naphthalene deposited in the mains and services.

There was also the common knowledge relating to the physical laws bearing on the subject—that of vapour tensions and the solubility of vapours in fluids. For instance, it was well known that, on bringing a gas containing the vapours of various hydrocarbons having different tensions into contact with hydrocarbon liquids having a solvent affinity for these vapours, but themselves giving off vapours of different tensions to those diffused through the gas, there was at once an exchange of vapours dependent on the relative tension of the vapours diffused through the gas and of those of the solvent liquids; and this exchange continued until there was an equilibrium attained between the solvent power of the liquid hydrocarbons to absorb the vapours from the gas, and of the gas to take up, in diffusion, the vapours from the solvent liquids. This law explains the practical observation in washing the shale gas with oil previously referred to——that so long as the quantity of the heavy oil was large, and brought into contact with the gas fractionally, the whole of the vapours were absorbed, because the balance between the oils to dissolve the vapours out of the gas, and of those vapours to remain in diffusion in the gas, was altogether and always in favour of the oil. When, however, the oil was not in sufficient quantity, the balance was disturbed, and those having the highest tension, possessing the greatest power to remain in diffusion, were absorbed to the least extent.

The foregoing law and observation showed that it was possible to absorb out of a gas containing the vapours of various hydrocarbons one of these vapours to the almost complete exclusion of the others, by maintaining a lack of balance between the constitution or composition of the solvent liquids and the particular vapour that it was desired to remove; so that the balance will always be on the side of the solvent fluid for the vapour which it is desired to remove out of the gas, while balanced for all others. Another physical law bearing upon our subject is that relating the condensation of the vapours of mixed hydrocarbons out of gas containing them. If it is desired to have the vapours of two or more hydrocarbons to condense simultaneously, they must be present in the gas in such quantities that their vapour tensions shall approach each other. This is still more essential when one of the hydrocarbons passes direct from the state of vapour to that of a crystalline solid, as in the case of naphthalene; and where under such solid state it has no solvent affinity for the other vapours with which it is associated. With the more volatile hydrocarbon—such as benzol and carburine—the quantity of vapours that would require to be present in the gas before their tension was lowered to be equal to that of the quantity of naphthalene in the gas, would be so great that the gas would necessarily smoke; and if present in less quantities, then these vapours would not condense out of the gas with the naphthalene. The result would be that the naphthalene would be deposited in the crystalline form. It is therefore evident that if it was desired to cause a liquid hydrocarbon to condense along with the naphthalene without causing too great an enrichment of the gas, it would be necessary to employ some hydrocarbon having a much lower vapour tension than benzol or carburine—in fact, one having a vapour tension more nearly approaching that of naphthalene.

Now the facts that I have narrated may have been common knowledge at the date of the Young and Glover patent; and they no doubt contain all the elements of knowledge necessary if combined and arranged into a concrete process to have anticipated that of Young and Glover. But the question is, Had there ever been previously described an aggregation of such common knowledge into a concrete process, showing how a supplementary supply of hydrocarbon fluid solvents could be so employed as to selectively wash out the naphthalene without washing out the other hydrocarbon vapours from the coal gas, or in carburetting or diffusing the vapours of hydrocarbon fluid having approximately similar vapour tensions so that they would, so to speak, selectively condense out with the naphthalene and dissolve it and prevent it being deposited as crystal?

If Young and Glover were the first to devise such a concrete process by combining these items of prior knowledge, if they were aware of the wide range of hydrocarbon liquids that could be employed for such a purpose, and if they explained in their patent specification that the essential feature necessary in the washing fluid was that it should be free from, or at least contain such a small quantity of, naphthalene as to leave the balance of solvent affinity in the washing fluid sufficient to enable it to absorb the naphthalene vapours out of the gas against their tendency to diffuse through the gas, while at the same time the solvent affinity of the washing fluid was balanced for all the other hydrocarbons present in the gas so that these were not absorbed, or, where so desired, that the washing fluid should contain an excess of hydrocarbons having a similar vapour tension to that of naphthalene so that the balance would be in favour of the gas to take them up in diffusion, or, alternatively, to diffuse through naphthalene charged gas the vapours of hydrocarbon liquid solvents having a vapour tension similar to, or approaching that of, naphthalene, so that they may selectively condense along with the naphthalene, dissolve it, and prevent it giving trouble from

being deposited in the solid form, and Young and Glover knowing the wide range of available fluids that could be employed in the way they described, they were surely entitled to claim the use of all of them. The correspondence that has since taken place—more particularly the claims made in connection with the origin of this correspondence—shows how valueless a narrower claim would have been.

Objection has been taken to the claims on the ground that, instead of being a definite claim specifying a definite solvent, they are so wide as to include all oil washing and carburetting processes as applied to gas. The descriptive matter in the body of the patent specification shows this is not the case; and the disclaiming clause of the specification distinctly says that Young and Glover "make no general claim to the washing of illuminating gas with liquid hydrocarbons for the purpose of absorbing the condensable hydrocarbons, nor yet do they claim the carburetting of coal gas by means of volatile hydrocarbons." The claims of the Young and Glover patent, quoted by Mr. J. Ferguson Bell in his communication appearing in your issue of the 1st inst., instead of being given *in extenso*, and of making the meaning of the claims clearer, as he says is his object, gives them a compass they were never intended to have; for he (for some reason best known to himself) omits, in the case of each claim, the important addition that the operations claimed were to be carried out "*substantially as described*." These three words narrow much the scope of the claims. Why did Mr. Bell omit them?

I have now, I hope, answered your query "What does that process compass?" and also said sufficient to show that the Young and Glover patent covers the Bell, Colson, and other similar applications of oil washing for the elimination of naphthalene from gas, and that Young and Glover are entitled, in connection with them, to something more tangible than credit. Although, however, thus speaking candidly and plainly—so as to remove the uncertainty that, if remaining, might militate against the application of a very useful system—I would regret much, and I have reason to believe my colleagues would also regret, that the something more tangible than credit which we think we are entitled to get should have a deterrent effect in preventing the gas industry benefiting by our labours. As I have already said, our main object in securing a patent for our invention was to have a legal document clearly explaining the nature and result of our labours, entitling us to ask credit for what we had done in the solution of the naphthalene problem, and, further, in the event of the results of our labours proving of great value to the industry, of also asking a share of the resulting economy; and in this regard I may be permitted to refer to the passage in the article on Mr. Colson's process at Leicester, in which it is stated: "It is a fact that it is estimated that the new remedy will have the effect of adding at least £5000 to the profits of the Gas Department." Assuming that Mr. Colson's estimate of the economies arising from the process to be correct, and freely conceding that he may have largely contributed to that saving by his own application of a modification of the process described and claimed in the Young and Glover specification, surely Young and Glover deserve an acknowledgment of their labours in the form of a small lordship or commuted royalty.

There is another matter to which I would like to draw attention, which, if left unexplained, might have an even greater deterring effect or deferring effect upon the full adoption of the Young and Glover process than any small amount of lordship asked for its use. The washing of naphthalene out of coal gas should be looked upon as a purifying process just as much as the washing of gas with pure water for the elimination of ammonia, or the use of oxide of iron for the elimination of sulphuretted hydrogen. Now the efficiency of the latter two processes can be at once shown by allowing a jet of the gas, after passing through the purifying arrangement, to impinge on a slip of yellow turmeric paper, which, as is well known, at once turns brown if ammonia be present, or, in the latter case, a slip of acetate of lead paper, which is at once blackened if sulphuretted hydrogen be present. Further, should gas containing either of these impurities escape perfect purification, more particularly sulphuretted hydrogen, its presence is at once made manifest all over the district of supply by the smell; and on the defective purification of the gas being rectified, the cause of complaint shortly disappears.

In the case of naphthalene purification, the conditions are in many respects different. There is no ready method of testing for the presence of naphthalene, such as for ammonia or sulphuretted hydrogen; for though the ingenious test devised by Dr. Colman has greatly simplified matters in this regard, the test for naphthalene still requires considerable skill to apply it—so much so that, in many cases, when oil washing for naphthalene has been tried, no test for the presence of naphthalene has been applied further than freedom from trouble from deposits of naphthalene in the district of supply. If the naphthalene, escaping the washing process and accompanying the gas, remained in the gas, and made itself manifest at once over the district of supply, as in the case of sulphuretted hydrogen, such a test for the presence of naphthalene would have been evidence that the washing process was not a success; but owing to the naphthalene possessing the power of leaving the gas and being deposited as a crystalline solid, and of revolatilizing again into the gas, such a test as that referred to is no reliable evidence of the effectiveness of the oil-washing process.

To go into anything like a detailed explanation of the method in which naphthalene behaves so as to bring about trouble from being deposited in the mains and services would extend this communication to a greater length than permissible, and, besides, it is scarcely necessary, as I have already fully described such action of naphthalene in the paper I had the honour to communicate to the Incorporated Gas Institute, on "Naphthalene from Retort to Point of Deposition,"* to which I refer those interested in the subject. Meantime, it will be sufficient for my purpose to give a practical illustration of the error that may be committed in applying such an apparently reasonable method of assessing the value of a naphthalene remedy process as that referred to.

The Sheffield Gas-Works have for a long period of years had great difficulties from the presence of naphthalene in the gas depositing in crystalline form; and those interested in getting over these difficulties have tried, and abandoned, a great number of methods or processes which promised to relieve them of their troubles. Among others, they have tried the Young and Glover process referred to by Mr. Ferguson Bell in his late communication as having turned out a complete failure, and, later still, other modifications of the Young and Glover process, but under other names, one of which has also turned out a failure, and I have no doubt, under like conditions, all others will unless there is a change in the method of testing their efficiency. We were told a considerable time ago that those in authority at Sheffield were hopeful they had at last discovered a remedy for their naphthalene troubles, consisting in the hot condensation of their gas, or rather restricting the temperature at which the gas was condensed to about 70° Fahr. Now we have seen the effects of hot condensation in the case of the Aitken and Young analyzing process, how that instead of reducing the naphthalene present in the gas, it rather tended to load the gas with naphthalene to such an extent as to ultimately partially block up the terminal chamber and connecting mains with masses of crystalline naphthalene; and there can be little doubt that, during the whole time the gas was leaving the condensers at 70° Fahr., it would be passing away so loaded with naphthalene that it would deposit it when the gas was subjected to lower temperatures. The reason why such naphthalene did not give immediate trouble was, I have no doubt, because, during the time the experiment was being made, the temperature conditions were such as to permit of it being deposited in positions not causing immediate trouble—such as the gasholder, trunk mains, &c., in the manner described in the paper contributed to the Gas Institute to which I have referred. That such depositions of naphthalene can take place is well known, as there are instances where tons of naphthalene have been removed in similar conditions.

Suppose, now, the temperature conditions to change in such a manner as to prevent the naphthalene present in the gas from the hot condensation being deposited in the same positions as before but be carried forward in the gas till the lesser and more exposed mains and services were reached, when, the temperature being low, it was deposited, it would at once begin to give trouble. Faith in hot condensation would then be shaken. But the temperature conditions might still further change; and part of the naphthalene previously deposited might revolatilize into the gas, when, in consequence, the trouble from naphthalene being deposited in the smaller mains and exposed services would be greatly intensified. Then, in all probability, faith in hot condensation would be lost, and the ordinary process reverted to. Now, suppose that, with their works and mains under such conditions, the Sheffield Gas Company were to introduce into their works a naphthalene removal process such as that of Young and Glover, and that, immediately after the introduction of this process, temperatures should again change into the original conditions, and, further, assuming that the Young and Glover process was being properly worked, and that the naphthalene was removed from the gas, then the purified gas, on entering the mains and coming into contact with the previously deposited naphthalene, would reassert its power to take up in diffusion some of it, but the temperature conditions being such as not to load the gas with naphthalene to an extent sufficient to cause its subsequent deposition in the smaller mains and services, the process would be given the credit it deserved.

The period of the year would, however, again come round when the temperature conditions would again change, and become such that the gas which had been perfectly purified from naphthalene by the Young and Glover process, on coming into contact with the previously accumulated naphthalene, would be able, owing to the higher temperature, to take up such a quantity as to cause it to redeposit some of it in the lesser and more exposed mains and services; and as the true cause of such deposits was not understood, the process would be condemned and discontinued. It is the power possessed by the naphthalene of being deposited from the gas at lower temperatures in positions, not making its presence manifest by giving trouble at one period of time, and the revolatilizing of that same naphthalene back into the gas, to be carried forward and be redeposited out of the gas in the more exposed mains and services under altered temperature conditions, which makes troubles from naphthalene deposits so puzzling and difficult to understand; and it will be evident from what has been said that, however perfect an oil-washing process may be in purifying the gas from naphthalene, the troubles

* See "JOURNAL," Vol. LXXV., p. 1712.

from naphthalene deposits may, after its adoption, from time to time recur (dependent upon temperature conditions), and continue for a length of time dependent upon the accumulations of naphthalene in the trunk mains, gasholder, &c., prior to the adoption of the oil-washing process. When, however, the oil-washing process is supplemented by, or combined with, the carburetting of the gas with the vapours of liquid hydrocarbons, solvents having a similar vapour tension to that of naphthalene, the troubles from previous deposits of naphthalene are more quickly removed; and this is more particularly the case when an excess of the vapours of those solvents is volatilized into the gas so as to cause a portion of them to condense out upon the surface of the previous deposits, as by this means not only is the naphthalene which may be revolatilized into the gas prevented from being redeposited in the solid form, but the naphthalene deposits are soon dissolved by the condensed excess vapours of the liquid solvent, and run to the nearest drip-pot for removal.

These remarks will explain the apparent failure of the Young and Glover process in the instances referred to in the recent correspondence on the subject in the "JOURNAL." Possibly, however, after Mr. J. Ferguson Bell has, as promised in his letters appearing in your issues of the 11th and 18th ult., "entered more fully into the application of the use of natural solvents obtained from coal tar for the removal of naphthalene deposits," and given "the results of his tests for naphthalene and solvents in the gas at various points, along with the experiments in washing with tar oil obtained from blast-furnaces, creosote, paraffin, &c., extending over many months at Derby," we may be in a better position to arrive at the true cause of failure there and at the many other towns. Meantime, however, I wish to put on record that my confidence in the Young and Glover process is quite equal to that of my colleague, Mr. Thomas Glover. The process is founded upon well proved scientific principles, which, if persistently applied in the manner described in the specification of the patent, will, I maintain, on whatever reputation I may possess, prove a perfect remedy for the worst naphthalene plagued distributing system in the country.

THE TESTING OF BURNERS AND MANTLES.

By H. LEICESTER GREVILLE, F.I.C., F.C.S.

I notice from a perusal of your columns that the above-named subject is attracting considerable attention, and that you invite any suggestions from readers. It seems to me the question might be almost regarded as a general one—viz., of the commercial value of gas illuminating appliances as opposed to their reputed value. The discrepancy between the actual and the alleged performance of new forms of burners and mantles has been an anomaly for some time past. The promoters of any new form of illumination have naturally a tendency to exaggerate the value of their offspring. How much is due to an honest belief in the value of what they are floating on the market, and how much they credit the gullability of the public, it would be invidious to endeavour to determine. We have only to refer to the question of electricity for a striking example. When the Jablockkoff arc light was introduced some years ago on the Thames Embankment, a value of 1000-candle power was claimed. As a matter of fact, the report of the Chemist and Engineer to the Metropolitan Board of Works proved the actual lighting value to be—

Naked light	378·1	candles
Opal globe	154·9	,,
Frosted globe	265 0	,,

A disparity is also apparent on the smaller lights. Tests made by Mr. Dibdin showed that the nominal 16-candle lamp gave an actual value of only 13 candles; while the reputed 8-candle power lamp gave 7·3 candles. What guarantee the consumer has as to any reasonable correspondence between electrical charges and lighting efficiency is still unfortunately an unknown quantity.

With regard to any particular method of testing incandescent burners and mantles, I am strongly of opinion that each must be taken on its own merits, at the discretion of an impartial and competent photometrist. I agree with Mr. Abady that no absolutely fixed conditions adaptable to all contingencies is possible. The incandescent system of illumination is essentially unique in its method of light development. So much depends on a multiplicity of conditions. Any ordinary flat-flame or argand burner will afford increased light for increased gas consumption (within reasonable limits). On the other hand, an incandescent burner can be turned up to maximum illumination, and then the least increase in gas consumption gives such a decrease in light as to be absolutely conspicuous to an average onlooker. We have so many factors in the question of obtaining the best possible results. Mr. Abady has ably criticized the general question of the subject that I will only briefly state a case from my own point of view. The first essential to a good incandescent burner is the maximum development of heat from the gas; the second (with a good mantle), is that the size of the mantle is so proportioned to the size of the flame that the maximum incandescence is obtained. With these conditions as initially necessary, a subsequent, but essential, condition for practical utility is the durability of the mantle. One universal system of testing is obviously impracticable.

Opinions necessarily vary upon the subject; but if I had to make a report upon some particular burner or mantle, I should be guided by the wishes of my client and by my own judgment. In making my report, the conditions of testing would be (to prevent any misconception) fairly and clearly stated. I can see no difficulty in obtaining a very good estimate of the value of any special appliance by ordinary well-known photometrical methods. On the question of the best value to be obtained for a particular combination of burner and mantle, that could only be obtained by experiment. The question of the durability of the mantle is a simple matter, with allowance of sufficient time for an efficient test. What course could be taken to prevent false statements being foisted on public credulity? No course can be taken so long as the public are willing to accept the uncorroborated assertions of interested parties. They take their own risk. The only remedy is due certification of the claims of any particular invention by an impartial expert, and the maintenance of decent business honesty by manufacturers, that the quality of their goods will be maintained to an efficient standard.

THE THIRLMERE WATER SCHEME.

Completion of the Second Pipe Line.

[COMMUNICATED.]

The recent completion of the contracts for laying the second line of pipes to convey water from Thirlmere to Manchester reminds us that the bitter opposition which the important scheme experienced in its parliamentary stage has been outlived. Engineering triumphs have "laughed at impossibilities;" and within a few years the gloomy forebodings of self-interested critics have been falsified, while the arguments of many opponents have not simply been refuted but ridiculed. When the original Engineer—the late Mr. J. F. La Trobe Bateman, F.R.S.—submitted his scheme to the Select Committee of the House of Commons, on March 5, 1878, he was met by the adverse petitions of 33 companies, associations, corporations, private owners, &c., describing in mournful terms the expected disfigurement of the scenery surrounding the lake, deploring the damage to important estates which the construction of the huge aqueduct was likely to cause, or making false prophecies of probable engineering failures. The Press was also a strong lever used by the opposing forces; and the Thirlmere Defence Association induced the late Bishop of Carlisle (Dr. Goodwin) to "appeal to the public opinion of England not to permit this piece of vandalism, or instead of a trip to the English Lakes they might hear of a trip to the Tanks, or a month at the Reservoirs." The Manchester Corporation, however, had their own Bishop (the late Dr. Fraser) to bless them. Manchester has conquered her difficulties, and set an example in water engineering enterprise. For suggesting the Thirlmere scheme, the city owes a debt it will never be able to repay to the late Alderman John Graves, who lived at Keswick when Mr. Bateman was requested to report on the possibility of bringing water from Thirlmere to Manchester in 1876. Mr. Graves was Chairman of the Water Committee when Parliament passed the Bill, and was soon afterwards succeeded in that office by Sir John Harwood, who laid the foundation stone of the embankment on Aug. 22, 1890, and has taken the deepest interest in the gigantic scheme from its inception. In 1885, it was estimated that the cost of bringing 50 million gallons of water per day from Thirlmere would be £4,500,000; but this will be considerably exceeded, because both iron and labour are dearer than twenty years ago. What has been done with the £3,100,000 already spent it will be the endeavour of the writer to explain.

An aqueduct has been constructed from Thirlmere to Manchester, 95 miles 1642 yards in length, comprising: Tunnels, 14⅛ miles; "cut and cover," 36¾ miles; pipes, 45 miles. The natural level of Lake Thirlmere above the sea was 533 ft. 2½ in. before Manchester decided to tap it; but by constructing the embankment at the outlet into St. John's Beck, the level of the lake has been raised nearly 35 feet. The length of the embankment is 857 feet, and its greatest height from the foundations is 104 ft. 6 in. In the deepest part it is about 50 feet thick; and the crowning masonry, which is 18 ft. 6 in. wide, provides a 16-feet roadway connecting the east and west sides of the lake. For the accommodation of tourists and dwellers in the district, two new roads were constructed on the shores of the lake; the one on the west side extending 5 miles 965 yards, and that on the east side 2 miles 242 yards. The road across the embankment is a little short of a mile long—1683 yards. When the limit of 50 million gallons per day is taken from Thirlmere, the level of the lake will have been raised to the height of 584 feet above sea level; but at present the actual height is 569 feet. The length of the lake has been increased from just over 3 miles to 3 miles 800 yards, or 300 yards longer than when the first pipe-line began to fulfil its mission; but when the scheme is complete, Thirlmere will be 3 miles 1100 yards long. Originally, 7400 acres of land drained into the lake; but the Manchester Corporation purchased land and manorial rights so as to divert into the lake the water in a gathering-ground of 3600 additional acres as was found to be necessary. The natural area of Thirlmere was 330 acres; but it has been increased to some 700 acres, with a capacity of about 5500 million gallons available for supplying Manchester. Ultimately, when the lake has been raised 50 ft. 9½ in., the surface area will be 793 acres; and the capacity 8135 million gallons,

from a drainage ground of 11,000 acres, compared with a drainage area of 19,300 acres in the Longdendale Valley scheme. The rainfall at Thirlmere, however, totalled to 104·03 inches in 1891, against 53·48 inches at Longdendale; and the average is 88·7 inches against 49·8 inches.

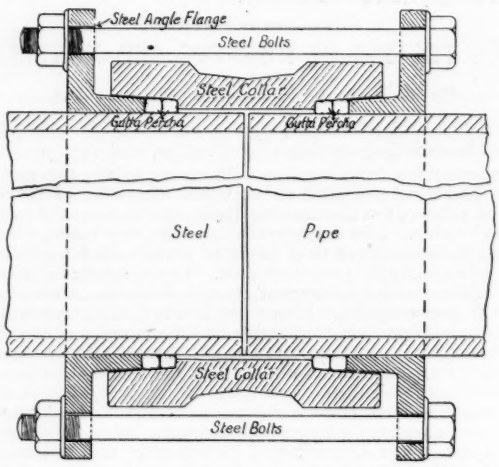
It is not anticipated that it will be necessary to divert the streams in the additional gathering-ground until the fourth and fifth pipes are laid. Two subsidiary aqueducts will be constructed—one on the east side of the lake, 1⅝ miles long, and the other on the west side. By a tunnel 1¼ miles long, this one will enter the lake just above the embankment and waste-water course. The straining-well for the admission of water into the aqueduct from the lake is 37 ft. 6 in. in diameter and 65 feet deep; the strainers being placed between eight cast-iron columns arranged octagonally. A washing chamber, constructed at right angles to the well, enables the strainers to be cleaned by jets of water discharged under pressure. The water enters the aqueduct through a 42-inch pipe at the bottom of the well. The stone buildings encasing the well, valve-shaft, &c., are of very pleasing design.

The tunnels and "cut and cover" portion of the aqueduct, constructed between 1885 and Oct. 12, 1894, are able to convey as much water as the five lines of pipes will carry. Where the rock is firm and no lining is required, the tunnels are 8 ft. 6 in. wide; but when lined by concrete they are 7 ft. 1 in. in width—the sides being 5 feet and the roof arching 2 feet high. The bottoms of the tunnels are concreted. In the "cut and cover" sections, the internal concrete work is similar to that in the tunnels. There are four long tunnels in the lake district; nearly 8 miles of the first 14 being bored. Dunmail Raise, which took 4½ years to drive through, is 5165 yards long; Nab Scar, 1419 yards; and Moor Howe, 3040 yards. Between the latter tunnel and the Ribble syphon there are 25 short tunnels, aggregating in length to 7748 yards; while between Preston and Horwich there are four tunnels of a total length of 3119 yards. The capacity of the syphon, of course, determines the supply. Though the first line of pipes, chiefly 40 inches in diameter, were estimated to carry 10 million gallons of water per day—and, in fact, did so for some time—the gauge has for several years recorded a shrinkage which leakages do not fully account for. The decrease is really due to the natural deterioration of the pipes. Manchester is thus experiencing the same difficulty as Liverpool. The pipes, after being in use some years, begin to show signs of incrustation, and barnacles or limpets are formed by the action of the water on the iron of the pipes, which in course of time considerably reduces their area. A more serious cause of the reduction of their water-carrying capacity is an organic growth; and Manchester is losing thereby about 1½ million gallons of water per day, or nearly one-seventh of the Thirlmere supply. Similar obstructions have been detected in the Liverpool pipes; and to provide against them Mr. James Mansergh added filters in his Elan Valley scheme for the supply of Birmingham.

The work in connection with the second line of pipes has been carried out under the direction of Mr. G. H. Hill, M.Inst. C.E., the Water Engineer for Manchester. The Contractors have been Messrs. Fisher and Le Fanu, of Belfast, for the northern section; while Messrs. Monk and Newell, of Liverpool, have done the work south of the Ribble. Their contracts have taken two years-and-a-half to complete. No fewer than 33 bridges of various designs carry the aqueduct over rivers, streams, and railways; and there are ten subways to enable the pipes to be taken under railways and a canal. As previously mentioned, the aqueduct from Thirlmere to near Ambleside is either tunnel or "cut and cover." Syphons then commence at intervals. The excavations in the dips are carried out to a depth of from 7 to 9 feet. The two most northerly syphons are at Scandale and Stockgill. The former is 290 yards long and dips 94 feet; while that at Stockgill is 570 yards long and 97 feet deep. Here there are three lines of pipes laid with a total carrying capacity of 50 million gallons per day. From Ambleside to Checkerbent, near Manchester, the new pipe is chiefly 44 inches in diameter, compared with 40 inches for the first pipe. On the Kent syphon, the pipes go under the river and later cross the Mint over an iron bridge. The "Beehive" syphon is south of Oxenholme, where the Windermere branch of the London and North Western Railway begins. After passing Hutton Roof, where leakages have been detected in the aqueduct, the next important syphon is that which crosses the Keer Valley, where the dip is 382 feet. The deepest drop on the track is, however, that down to the River Lune, opposite Caton, four miles east of Lancaster, where the syphon is carried over a handsome bridge with three spans of 70 feet each; the ornamental cast-iron arches resting on stone piers. The pipes are carried on longitudinal steel-rolled joists resting on the bearing course of the piers, and on the transverse girders. They are protected from the weather by inverted U-shaped plates securely riveted. The length of this bridge is 324 feet; and it crosses the Lune at an angle of 66 degrees. There is a bridge of similar design at Troutbeck (it has one span of 70 feet); the Ribble Bridge at Preston is 296 feet long; and another spans the River Irwell at Agecroft, Manchester. The Ribble syphon is the longest, being 9½ miles in length. The dip is 379 feet, and the bridge crosses the river on the square. After passing Preston, the track cuts into the coal district of Lancashire, and several railways are crossed; the pipes being carried on neatly-designed tubular bridges. This provision is made so that if a pipe bursts on the bridge the water will run through a special overflow at the end of the bridge instead of damaging the railway. There are seven of these bridges within ten miles of Prestwich. In this length the pipes are 40 inches in diameter, compared with 36 inches for the first pipes.

The capacity of the second syphon is from 12 to 14 million gallons per day; so that "organic obstructions" should not prevent at least 10 million gallons of Thirlmere water reaching Manchester daily. The two Prestwich reservoirs will hold 41 million gallons, which is not considered to be sufficient; and it is proposed, as readers of the "JOURNAL" are doubtless aware, to construct a new one at Heaton Park, Manchester, which will store about 500 million gallons. In the event of an accident to the aqueduct from Thirlmere, this would ensure the city a three weeks' supply. This new scheme will entail an expenditure of £1,215,000, including the cost of a 16-mile aqueduct to enable Thirlmere water to be discharged into the Audenshaw reservoirs on the east side of the city, which have a total capacity of 1441 million gallons. The seven collecting and storage reservoirs at Longdendale have an aggregate capacity of 4187 million gallons; and the service reservoirs supplied from them, at Godley, Denton, Audenshaw, Gorton, and Prestwich, have a capacity of 1799 million gallons, or equal to a supply for 150 days for the city and about 20 adjoining townships covering an area of 85 square miles. The cost of the Longdendale scheme was £3,162,577.

Although about 1200 men were regularly employed on the pipe track, the number of fatalities has fortunately been comparatively few. Several bursts took place on Messrs. Fisher and Le Fanu's section, and they were traceable in every instance to the fact that the first pipe had been resting on sharply-pointed rock. Bursts occurred on the Lune syphon near Brookhouse; on the Mint syphon near Kendal; on the Sidehouse syphon between Burneside and Staveley; and on the Kent syphon. In the section for which Messrs. Monk and Newell were the Contractors, there were two bursts—one at Lostock junction and one nearer Prestwich, due to colliery workings causing the pipes to sink. In every

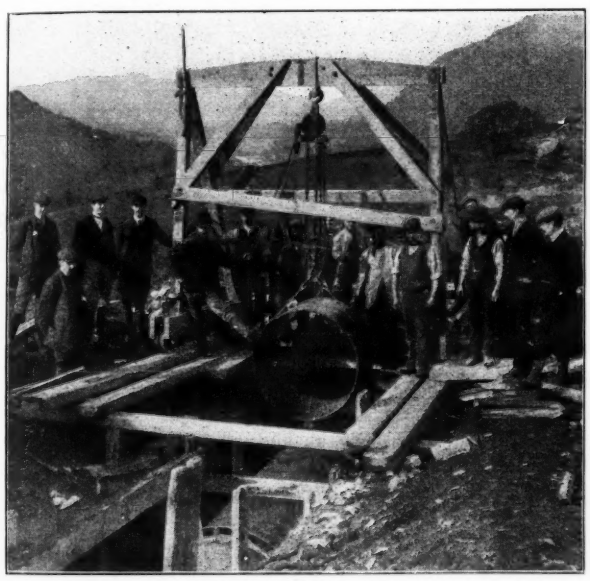


case the automatic valves worked admirably, shutting off the water at once; so that that which escaped was only from the burst length. The damage was not serious, with the exception of the Staveley accident. But the laying of the second line of pipes has evidently not been accomplished without danger; and it is creditable to the Engineers and Contractors that there has been so small a percentage of fatalities.

Mr. Bateman's original estimate of the cost of laying the second line of pipes was £373,000; but the contracts amount to about £600,000. Since the first estimate, labour has advanced from 4½d. and 5d. to 5½d. and 6d. per hour. Iron is also much dearer than it was during the first contract. The manufacturers supplying the pipes were: The Wigan Coal and Iron Company for the Manchester section; the Staveley Coal and Iron Company, for the Barnacre and Preston section; Messrs. Macfarlane, Strang, and Co., for the Borwick to Bay Horse section; and Messrs. D. Y. Stewart and Co., for the Windermere to Burton and Holme section. The pipes on the first line were all of cast iron; but in the second line where they are laid on bridges or in subways, as well as in the Grizedale and Hulton tunnels, steel pipes have been used. In the case of bridges, provision was originally made for the five lines of pipes, so that no extra work was entailed other than the actual placing of the pipes. The third pipe has been laid across the bridges, so as to avoid cutting into the masonry again for some years. There was nothing unusual in the method of laying the pipes. All angles and changes in the gradient in the pipeline have been made with bevel collars. With these specific angles, any angle can be made up to the required size. The total number of cast-iron pipes was 22,200; of special castings, about half of which are bevels, 4700; and of lead joints, 24,300. The total weight of cast-iron pipes was 63,000 tons, or 11,000 tons more than the first line; the difference being due to the larger diameter of the second line. The total number of steel pipes was 320, and their weight 975 tons. Most of the steel pipes are 24 feet in

length; but a few are 16 feet and 8 feet long. Flange collars for steel pipes are used in tunnels and subways where there is not sufficient room to make lead joints with safety. They consist, as will be seen from the diagram, of a steel collar of much the ordinary pattern, but instead of the usual yarn and lead joint two rings of gutta percha are inserted in the space generally leaded. A circular angle-iron ring, machined to fit the inside of the collar as well as the external diameter of the pipes, is inserted on either side of the collar; and by drawing these two collars towards each other by long bolts through their vertical flanges, the gutta-percha rings are squeezed or caulked up against the back of the collar. This ensures a good water-tight joint, even under the heavy pressure to which they are subjected.

The valves have been supplied by Messrs. Glenfield and Kennedy and Messrs. J. Blakeborough and Sons. Besides a very large number of air-valves and discharge-valves for cleansing and emptying the pipes, there are five different types of large valves fixed at various points on the main pipe-line for shutting off the water in the event of a burst taking place in the syphons. Four of them are automatic in their action, and one has to be closed by hand. All the five types are used on the long syphons; but on the short ones only two of the large valves are used—one at the north or inlet end, and the other at the south or outlet end. Taking them in the order in which they occur in the line of pipes, they may be designated as north well bell-valves, automatic or self-acting stop-valves, manual stop-valves, reflex valves, and outlet valves in the well at the south end of the syphon.



Laying the Last Pipe at Scandale, near Ambleside, Oct. 26, 1904.

[The Engineer, Mr. M. R. Barnett, M.Inst.C.E., is in the front, on the left of the photograph.]

The last pipe was laid in the presence of the Engineers at Scandale, near Ambleside, on the 26th of October. When Lake Thirlmere has risen 50 feet nearer to the summit of Castle Rock, two narrow promontories which formerly almost divided the lake will disappear, and Deergarth How and Hawes How change from miniature peninsulas into little islands. The latter is studded with beautiful trees and covers four acres—a picturesque reminder that Manchester has tried to keep her promise not to mar a landscape which poets have immortalized.

Society of Arts.—The first meeting of the 151st session of the Society will be held to-morrow, when an opening address will be delivered by Sir William Abney, K.C.B., F.R.S., &c., the Vice-President, and Chairman of the Council. Among the Cantor Lectures to be delivered during the session is a course of four, by Mr. Dugald Clerk, on "Internal Combustion Engines." The dates fixed are Feb. 13, 20, and 27, and March 6, 1905.

Institution of Civil Engineers.—At the opening meeting of the present session of the Institution, held last Tuesday week, the new President—Sir Guilford L. Molesworth—in the course of his Inaugural Address, stated that when he joined the Institution in 1854, the total number of members of all classes was 773. It was now 7633—almost a tenfold increase; and the material and intellectual advance had quite kept pace with the numerical progress. He then proceeded to treat of the public works of Ceylon and India, with which he has been connected for more than thirty years of his professional career.

LONDON AND SOUTHERN DISTRICT JUNIOR GAS ASSOCIATION.

Visit to the Kensington District Office and Show-Rooms of the Gaslight and Coke Company.

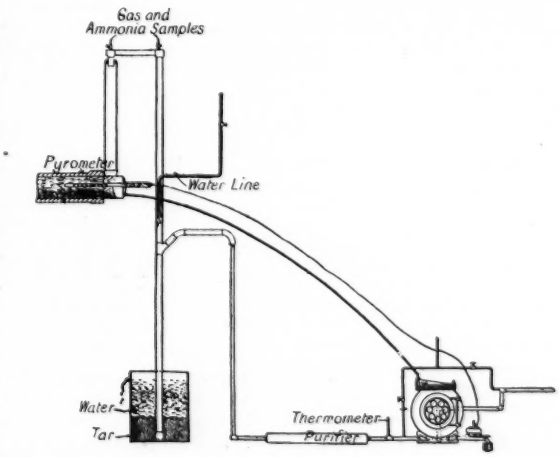
At the invitation of the Inspector in Charge, Mr. Pilbrow, a party of members of this Association on Saturday inspected the Kensington show-rooms and offices of the Gaslight and Coke Company. The party were received by Mr. Pilbrow, who personally conducted them through the building, and was assisted by Mr. Rothwell, a member of the Association. The members were greatly interested in the unique display of material for effective and artistic lighting; and fittings were shown which it would be difficult to discern from electric light, but for their greater illuminating power. They were also able to make comparisons between various styles of stoves, &c., which was a great advantage to some of the members whose companies only supply one make. Another item of interest was a gas-engine coupled to a dynamo, which it was explained was a model of that recommended by the Company to those consumers who were obdurate in their preference for electric light. The well-appointed and spacious show-rooms were greatly admired; and the splendid advertisement of the International Gas Exhibition attracted much attention.

At the conclusion of the inspection, the party were invited to tea, after which, in the regretted absence of the President of the Association (Mr. Walter Grafton), the Hon. Secretary (Mr. P. F. Scarth) proposed a vote of thanks to Mr. Pilbrow for the kindness he had shown them that afternoon, and for the trouble he and his assistants had taken in explaining the various items of interest. Mr. F. Ainsworth, of Ilford, seconded the proposition. In responding, Mr. Pilbrow said it had given him great pleasure to meet the members, and he hoped all of them had benefited by their visit.

TEMPERATURE AS APPLIED TO COAL GAS PRODUCTION AND PURIFICATION.

At the Annual Meeting of the Michigan Gas Association, the following paper on the above subject was read by Mr. V. F. Dewey, the Assistant Superintendent of the Detroit City Gas Company.

Any discussion of the subject before us involves several varying factors, the principal of which is the kind of coal. I have consequently selected as the standard for examination the ¾-inch screened Youghiogheny gas coal, not because I think it the best, but because of its extensive use. The apparatus employed in the tests is as follows: A 60-inch Le Chatelier 10 per cent. rodium-platinum thermo-couple, with a Siemens and Halske pyrometer voltmeter. The stand-pipe of one retort was connected by means of a 4-inch pipe and a piece of 6-inch pipe to a station meter drum. The 4-inch pipe was 20 feet long, and so arranged that a spray of water could be turned inside it for the purpose of



cooling the gas. The 6-inch pipe was filled with "excelsior," to prevent tar reaching the meter. The gas was drawn from the retort by means of a steam-jet exhauster placed at the outlet of the meter; and a pressure-gauge reading to 1-100th of an inch was attached to the meter casing. The lid of the mouthpiece was tapped in two places—one for admitting the thermo-couple, the other for making connections by means of rubber-tubing to the pressure-gauge on the meter; thus permitting the operator to keep the pressure on the retort practically constant. From 2-10ths to 3-10ths of an inch was maintained throughout tests. The apparatus is shown in the accompanying diagram.

The thermo-couple extended into the retort from the lid only 44 inches, or 30 inches inside the end of the retort. Consequently, the temperature readings would be lower than the actual temperature of the retort in the middle and back end. The gas samples for analysis were taken from the top of the stand-pipe. The ammonia was determined by regular stand-pipe tests; gas being drawn off at the top of the pipe. Ammonia tests were taken continuously—one each hour. Gas samples for analysis were taken every half hour; the first sample in each case being drawn about ten minutes after the test was started. Data on the following things were determined: (1) Comparative temperature of carbonization. (2) Yield of gas at different heats. (3) Production of gas during the charge. (4) Yield of ammonia at different heats. (5) Production of ammonia during the charge. (6) Analysis of gas at different periods during the charge, showing the change in the chemical composition of the gas. (7) Production of coke at different heats. [No information was gained regarding the production of tar, owing to the inability to collect the amount made.]

Tables I., II., III., and IV. are analyses of gases produced at different periods of the charge, and the temperature at the time the sample was taken.

TABLE I.—*Charge No. 2.*

Hour.	H_2S	CO_2	O_2	C_nH_{2n} and C_nH_{2n-6}	CO	CH_4	H_2	N_2	Temp. Deg. C.
1	1·2	1·0	0·2	8·9	7·9	49·9	30·6	0·3	610
2	0·8	1·6	0·5	5·5	7·7	45·8	35 2	2·9	660
3	0·7	0·8	0·3	3·2	7·4	36·6	45·4	5·6	705
4	0·2	0·2	0·5	0·5	6·8	26·3	60·9	4·6	670
5	0·0	0·3	0·2	0·3	6·2	19·8	63·1	10·1	700
6	0·0	0·0	0·2	0 1	6·9	12·2	69·1	11·5	700
6½	0·0	0·6	0·2	0·0	7·4	8·2	68·3	15·3	700

TABLE II.—*Charge No. 3.*

1	0·8	1·6	0·3	11·4	6·1	59·8	16·1	3·9	590
2	1 0	1·0	0·4	7·2	6·9	48·3	30·8	4·4	640
3	0·7	0·8	0·3	5·1	6·6	42·8	40·2	3·5	665
4	1·1	0·9	0·3	3 9	6·4	39·9	41·0	6·5	690
5	0·4	0 6	0·2	1·6	5·7	32·5	52·8	6·4	705
6	0·2	0·6	0·1	0·1	4·4	10·7	74·2	9·7	710
7	0·2	0·3	0·1	0·0	5·4	7·1	72·5	14·4	715

TABLE III.—*Charge No. 4.*

1	0·9	1·4	0·5	8·6	8·7	49·6	23·0	7·3	650
2	1·2	1·0	0·2	6·1	8·4	40·1	36·2	6·8	650
3	0·7	0·7	0·2	2·0	7·3	30·8	54·2	4·1	700
4	0·2	0·1	0·0	0·0	5·1	10 4	76·6	7·6	740
4½	0·0	0·3	0·1	0·0	11·2	5·9	68·9	13·6	740

TABLE IV.—*Charge No. 5.*

1	0·4	0·8	0·1	8·0	8·5	46·3	31·3	4·6	660
2	0·5	0·9	0·2	6·9	8·3	44·2	34·2	4·8	760
3	0 4	0 8	0·0	3·1	8·0	30·2	51·5	6·0	780
4	0·0	0·4	0·0	0·0	10·2	6·0	67·6	15·8	800

Table V. shows analyses of coke-oven gas produced at different hours during carbonization; the numbers above the columns indicating the hours after charging.

TABLE V.

[A. Illuminants. B. Marsh gas. C. Hydrogen. D. Carbon monoxide. E. Carbon dioxide. F. Oxygen. G. Nitrogen. H. Calorific value of gas in British thermal units. I. Do. by the Junkers calorimeter.]

—	1	2	4	6	8	10	13	16	19	22	25
A	6·6	6·7	5·6	5·0	4 4	4·0	2·8	2·1	1·0	0·5	0·1
B	42·7	38·6	35·6	33·7	33·4	33·7	30·8	28·7	20·7	17·6	14·1
C	32·6	35·2	41·6	44·5	42 2	42·6	48·2	52·4	62·7	64·2	63 6
D	8·2	8·0	8·2	8·2	8·4	7·9	8·9	8·8	8·2	9 3	10·0
E	3·4	3·5	3·6	3·7	3·4	3·4	2·8	2·3	1·8	1·6	0·7
F	0·4	0·4	0·4	0·3	0·4	0·5	0·4	0·4	0·4	0·4	0·4
G	6·1	7·6	5·0	4·6	7·8	7·9	6·1	5·3	5·2	6·4	11·1
	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0
H	762·4	729·5	692·5	667 0	641·4	834·2	595·7	569·7	498·0	453·2	406 2
I	742·6	739·9	722·5	691·6	652·0	639·1	621 1	599·7	503·4	449·4	397·8

Table VI. shows the varying percentage of the total production, at different hours during the charge, of both gas and ammonia:

TABLE VI.—*Percentage of Total Gas and Ammonia Given Off Each Hour.*

Hr.	Charge No. 1. Gas.	Amm.	Charge No. 2. Gas.	Amm.	Charge No. 3. Gas.	Amm.	Charge No. 4. Gas.	Amm.	Charge No. 5. Gas.	Amm.
1	35·2	27·7	26 1	16·4	17·5	14·6	31·2	23·6	35·1	34·3
2	23·6	27·8	26·3	23·3	17·0	18·7	28·3	32·3	30·8	34·3
3	17·3	21·0	25·1	35·1	16·9	20·5	25·7	29·1	27·5	26·7
4	16·8	17·3	13·0	16·2	16·9	20·2	13·8	14·1	6·4	4·7
							25 minutes			
5	6·3	5 3	7·0	8·0	15·7	14·7	1·0	0·9	..	..
	45 minutes		50 minutes							
6	0·8	0·9	2·0	1·0	14·5	10 4	..	..	..	..
7	..	..	..	..	1 5	0·9	..	..	..	..

TABLE VII.—*Comparative Results.*

No. of Charge.	No. of Hours Carbonizing.	Heats. Colour Test.	Temperature of Retort, Deg. C.	Amount of Coal Charged.	Pounds of Ammonia per Ton of Coal.	Yield of Gas per Pound of Coal.	Per Cen. of Coke from Coal.
1	5½	..	660	170	2·440	2·67	76·40*
2	6½	..	700	300	5·366	4·71	67·20
3	7	..	715	410	5·434	4·76	64·10
4	4½	..	810	352	4·980	5·06	64·48
5	4	..	880	350	5 100	5·17	63·71
Coke oven	34	..	.	.	..	4·63	71·13

* Short retort with back half blocked.

Table VIII. contains calculated analyses of average sample of the total gases; also the heat units calculated. The illuminants being taken as ethylene, the heat values of the gases are: Ethylene, 1603; CO, 320; H_2, 325; and CH_4, 1024.

TABLE VIII.

A. Charge No. 2. B. Charge No. 3. C. Charge No. 4. D. Charge No. 5. E. Oven gas, (*a*) rich and (*b*) poor. F. Coal gas manufactured by the Detroit City Gas Company in 1900, with four-hour charges. G. Coke-oven gas.

	H_2S.	CO_2.	O	C_nH_{2n} C_nH_{2n-6}	CO.	CH_4.	H_2	N_2.	Gross B.T.U. per Cubic Foot.	Gross B.T.U. per Pound of Coal.
A. . .	0·7	1·0	0·3	4·8	7·5	38·2	42·3	5·2	630·13	2968·0
B. . .	0·7	0·9	0·3	4·8	6·0	39·4	41·6	6·2	637·00	3032·3
C. . .	0·8	1·0	0·3	4·8	7·7	36 5	42·6	6·3	611·57	3095·0
D . .	0 4	0·8	0·1	5·6	8·4	38·5	40·2	6·0	642·20	3320·0
E (*a*) .	..	3·6	0·3	5·2	6·1	38·7	38·4	7·7	625·58	..
E (*b*) .	..	2·2	0·3	2·4	6·3	29·2	50·5	9·1	522·50	..
F. . .	..	1 2	0·1	4·2	5·4	37·1	43·1	8·9	605·15	..
G . .	..	2·2	0·3	3·8	6·3	33·9	44·5	9·9	574·47	2660·8

Naturally, considerable difficulty was experienced in getting every part of the apparatus to work properly; and consequently a number of tests were made which were not satisfactory, and have not been taken into account in the tabulation of the preceding data.

The necessity for study along the lines indicated in the paper is emphasized by the fact that scarcely any authentic data could be found on the make and analysis of gas from American coals at various heats and at different periods during the charge, except some work done by the bye-product coke-oven people. Every technical book referring to the gas business speaks entirely of English and Continental practice; and practically all the scientific data in them are gathered from the same sources. That there is a marked difference in the composition of the gas from English and American gas coals is shown at a glance when the two analyses are placed side and side. This indicates a difference in the coal, and means that American coal-gas practice cannot be along exactly the same lines as the English practice. That there is a difference between the two practices is known to us all. Unfortunately, American coal-gas practice has not settled down to a definite scientific basis along adopted lines. This will never come about until the scientific men in the gas business and in the Universities turn their attention to this subject in earnest, and settle the exact scientific treatment for each American coal, and thereby place the manufacture of American coal gas on a scientific basis comparable with the magnitude and importance of the business, and on an even footing with our English cousins.

A careful study of the foregoing tables reveals the following very interesting results: (1) That a moderate heat gives a yield of gas of about 4·8 cubic feet per pound of coal and a maximum yield of ammonia; that the heat units per cubic foot of gas are high. (2) That high heats give a yield of gas of from 5·1 to 5·2 cubic feet per pound of coal with a moderate amount of ammonia; and that the heat units per cubic foot of gas are practically the same as at a lower heat. (3) That as the yield increases the percentage of coke produced slightly decreases. (4) That with four-hour charges practically all the gases are given off in the first three hours, during which time the amount uniformly but slightly decreases until there is a rapid fall in the amount of gas produced. (5) The grains of ammonia produced per cubic foot of gas increase to a maximum in the middle of the carbonizing period. (6) The quantities of gas and ammonia produced in the last hour are small, and the quality of the gas is very poor. (7) A coke-oven gas plant, apart from its utility as a coke producer, is a poor method of transferring to the consumer the quantity and quality of gas, as compared with ordinary retort practice.

Unfortunately, we were unable to take the make and quality of the tar produced; but, quoting from English practice, as described by Lunge, attention may be called to the following table, which shows that the higher the heat the greater is the percentage of pitch formed:—

Cubic feet of gas yielded per long ton of coal .	6600 ..	7200 ..	8900 ..	10,162 ..	11,700
Specific gravity of the tar	1·086 ..	1·102 ..	1·140 ..	1·254 ..	1·206
Composition of tar (percentage of weight)—					
Ammoniacal liquor	1·20 ..	1·03 ..	1·04 ..	1·05 ..	0·383
Crude naphtha .	9·17 ..	9·65 ..	3·75 ..	3·45 ..	0·995
Light oil . . .	10·50 ..	7·46 ..	4·47 ..	2·59 ..	0·567
Creosote oil . .	26·45 ..	25·83 ..	27·29 ..	27 33 ..	19·440
Anthracene oil. .	20·32 ..	15·57 ..	18·13 ..	13·77 ..	12·280
Pitch	28·89 ..	38·80 ..	41·80 ..	47·67 ..	64·080

Quoting again from the same authority: "Tar produced at 800° C. contains 15 per cent. free carbon, at 1100° C. from 25 to 30 per cent. free carbon." The kind of coal has much to do with the amount of free carbon in the tar. A West Virginia coal, when subjected to high heats, will yield a tar containing about 40 per cent. of free carbon; while the same coal carbonized at medium to low heats produces a tar containing only about 20 to 25 per cent.

The quantity of naphthalene in tar increases as the heats are raised. The tar produced at medium heats undoubtedly has a higher value for every purpose than that produced at high heats. Thus we come to the first question: "Shall we have high or low heats?" Manifestly this depends upon local conditions. I will simply suggest a course of procedure. During the maximum demand for gas, force your benches to their limit. As the demand diminishes, gradually lower your heats rather than shut down some benches and maintain high heats on those remaining. The reason for this deduction is that a heat which will give a yield of 4·8 cubic feet of gas per pound of coal, apart from the increased interest and depreciation charges, will produce gas at a slightly less net cost per 1000 cubic feet than gas produced at a very high heat. In other words, the differences in the residuals, furnace fuel, and retort-house labour per 1000 cubic feet more than make up for the increased yield per pound of coal at a high heat. As regards the difference in the quantity of furnace fuel required to decarbonize at a high and a low heat, a test was made in Detroit. The two benches selected were side and side, and both in the same condition. The primary and secondary air-slides were set very carefully, so that a maximum of carbon dioxide would be present in the waste gases. The temperature and the analyses of these gases were taken frequently; and at the same time the furnace fuel was weighed. It was found that the amount of furnace fuel consumed per ton of coal carbonized at a high heat was 8 per cent. more than at low heat. This corresponded very closely to the efficiency results calculated from the analysis and temperature of the waste gases.

In conclusion, I may say I realize that I have only touched the outer edge of the subject, which is so broad and inclusive that it demands further and more expert study than I have been able to give to it. I shall be satisfied, however, if I have instilled into someone the desire to take it up and thoroughly investigate it.

A PRACTICAL SOLUTION OF THE WATER-GAS QUESTION.

The following is an abstract account of an article, written by Herren Placidi and Kettner, which appeared in a recent number of the "Journal für Gasbeleuchtung."

The Phenomena of the Blow.

When a generator, even one with a considerable depth of fuel, is blown up with air entering at a constant speed, combustion takes place which is more or less complete at first, but gradually becomes less so, until, after a time, a gas passes away containing little or no carbon dioxide. At the moment when the amount of carbon monoxide becomes constant, and cannot be increased by further blowing, the generator has attained its equilibrium, its mean temperature cannot be raised, and the gas escapes at a constant temperature. The heat liberated during any period of time in such a generator is equal to that contained in the gas which passes off during this period (apart from its heat of combustion) *plus* the heat lost from the apparatus by radiation. But the temperature in the generator is not uniform throughout the whole mass of fuel; for, owing to the original combustion of carbon to dioxide, it increases from the spot where the air enters to a maximum at the place where the oxygen is exhausted, and thence it falls again, owing to the reduction of the dioxide to monoxide, which is an endothermic reaction. Before the generator has reached its equilibrium, its mean temperature is still low, and the upper layers of fuel are still cool. For this reason they have little reducing power; and so the escaping gas contains the more dioxide as the generator is the further from its position of equilibrium.

As the upper layers of fuel in a deep generator are cooler than those where the combustion is proceeding, if some of them are removed the residual fuel will have a higher mean temperature than before; while if a generator which has reached its point of equilibrium is treated in the same fashion, the residual fuel will not only have a higher mean temperature than before, but the escaping gas will contain a larger proportion of carbon dioxide. Manifestly, too, if before equilibrium is attained the top layers of fuel are hot enough to exhibit reducing powers, their removal will also increase the proportion of dioxide in the gas. Moreover, in all cases the gas thus made richer in dioxide will also be hotter. If, now, a low mean temperature of the residual fuel would suffice, the generator would not take so long to blow up, while the gas would contain a still larger proportion of dioxide, and would escape at a lower temperature. Strache considers that it is advantageous to have a greater depth of fuel, because the upper cool layers should absorb some of the sensible heat from the lower layers, where dioxide is being produced; but this view must be contradicted, in spite of the lower temperature of the escaping gas so obtained, because of the smaller quantity of dioxide in the gas, and because the mean temperature of the generator is reduced by increasing the depth of fuel.

A reduction in the depth of the fuel involves a shorter period of contact between the gas and the fuel; and the time of contact is the real factor in causing the decomposition of carbon dioxide. This rule applies to all industrial furnaces as well as to water-gas generators, so that by altering the time of contact during a blow of given length, the dioxide in, and the temperature of, the escaping gas can be regulated. If it were not for the way in which the temperature of the generator increases during the period of a blow, it would be possible to have any desired proportion of dioxide in the gas by controlling the time of the blow and of the contact between the gas and fuel. But the time of contact can be altered without changing the depth of fuel—viz., by altering the speed of the blast; for the time of contact is directly proportional to the depth of the fuel, and inversely proportional to the speed of the air blast. When this speed is increased so that the time of contact is reduced, the same phenomena occur as when the depth of fuel is decreased—the gas containing more carbon dioxide and being hotter. Strache has already noticed this without finding a sufficient reason; but it should be observed that he calculated the mean temperature of the generator at the beginning of the blow by adding a constant to the initial temperature of the gas, using the same constant in all his experiments, although the periods of contact sometimes differed.

A strictly mathematical formula to express the relationship between the period of contact of gas and fuel and the amount of carbon dioxide in the gas, and to show how the dioxide in the generator decreases with increasing temperature and duration of the blow, is badly wanted. In the meantime, two generators with roughly the same depth of fuel, worked the one according to the Strache system with a long period of contact, and the other according to the Dellwik-Fleischer system with a short period, may be imagined. In the Dellwik apparatus, the mean temperature will be 1200°; and the gas will leave it at a temperature of 900°, containing on an average 13 per cent. of dioxide. In the Strache apparatus, the mean temperature will be 800°, the gas will be at 450°, and the dioxide in it 6 per cent. If about half the fuel were removed, the phenomena in the Strache generator would closely resemble those in the Dellwik plant.

By carelessness, the depth of fuel in a generator may become too small. This will decrease the period of contact, and will increase the amount of dioxide in the gas—making the apparatus a kind of furnace. But this is not economical, because during the subsequent run the time of contact between steam and fuel will be too short, and much steam will pass into the water gas undecomposed. If, on the other hand, the depth is too great, the air blast must be driven at such a high speed and pressure through the fuel in order to insure sufficiently brief contact that lumps of coke may be projected out of the generator; the heat they carry with them being wasted. Too large a quantity of heat should not be stored up in the generator, or its temperature may become excessive. A high temperature in the plant encourages loss of heat as sensible heat in the generator gas and the water gas. The best mean temperature of the generator lies between 900° and 1200° C.

The Economy of Water-Gas Manufacture.

In considering the ultimate technical economy of a water-gas plant, it is necessary to bring into notice the efficiency of all the subsidiary items of the installation—*e.g.*, to make allowance for the heat consumed in steam raising, and to calculate as heat the energy used in bringing the air current to the desired pressure and speed of motion. Hence there are two points to study: (1) How to attain a high efficiency in the generator itself; (2) how to achieve a high efficiency over the whole plant.

Generator Efficiency.—High generator efficiency is to be attained during the blow by making the time of contact between the gases and the fuel suitably short, so that the formation of a gas rich in carbon monoxide may be prevented, and by not allowing the generator to be blown into its state of equilibrium. During the run, the time of contact between the steam and the fuel must be long enough to insure complete decomposition of the vapour; but excess must be avoided, or the make of gas per unit of time will be too small. If, during the blow, the generator gas is allowed to escape as rapidly as possible from numerous apertures at different levels in the apparatus, the air need not enter at such great speed and at such high pressure as is otherwise necessary to keep the time of contact short, and by this arrangement the consumption of energy in maintaining the blast is decreased. Lateral outlets in the generator of the kind suggested also afford much control over the blow and the amount of dioxide in the gas, for this amount will be the greater as the aperture which is opened is nearer to the grate. During the subsequent run, the steam should be caused to travel through all the fuel; and if the speed of the current is lowered by an automatic governor as the temperature of the generator falls, a water gas of uniform quality will be obtained.

Efficiency of the Entire Plant.

Having attained a high efficiency in the generator itself in the manner already described, it remains to be seen how the losses of heat from the generator in the shape of carbon monoxide and sensible heat in the gas of the blow may be best recovered. Two

processes have been suggested for the purpose—superheating the steam or warming the air, and an employment of the gas for raising the steam. Owing to the intermittent character of the operation of water-gas manufacture, regenerators have the disadvantage of being relatively inefficient, and, if they are used to superheat the steam, of contaminating it with the gases of the blow. Moreover, the sensible heat of the water gas itself cannot be recovered through the agency of regenerators. A heating of the blast is also difficult in practice, because the temperature of the waste gas does not reach its maximum till the end of the blow, and because the material of which regenerators are usually constructed is a bad conductor of heat. The best substance for absorbing heat is that which takes up a large quantity without becoming very hot—*i.e.*, one with a high specific heat, because the transfer is best effected between two substances that are as different as possible in temperature. This indicates water to be the best material for absorbing the heat; since to raise a unit weight of it through a known thermometric distance 15·8 times as much heat is requisite as in the case of the same weight of air, and 7·9 times as much as in that of superheated steam.

The idea of employing the sensible heat as well as the carbon monoxide in the waste gases for steam raising is not new; and the reason why it has not hitherto given satisfactory results is simply that the operation has not been carried out in a suitable way. The sensible heat of the water gas can also be utilized in warming the feed water—a process that has the additional advantage of decreasing the consumption of water in the scrubber, which usually acts as a cooler. When the sensible heat of the water gas is employed in heating the water, and the generator gas is used to convert it into steam, practically all the heat escaping from the generator can be recovered.

A high efficiency over the whole plant is only to be obtained if the heat recovered from the gases is equal to the heat required in their formation, *plus* the heat equivalent to the steam consumed by the blowing-engine. But since a steam-boiler works more economically with gas than with coal firing, since the efficiency of a boiler is higher than that of a water-gas generator, and since the temperature of the flue gases in a good boiler is always lower than that of the generator gas in a water-gas plant running efficiently, it follows that, in a properly managed water-gas installation, the heat needed to raise steam can be obtained by regeneration; and only when this is achieved can it be said that the maximum of general efficiency has been reached. Hence, although a high proportion of carbon dioxide in the generator gas shows that the generator is working efficiently during the blast, if too little monoxide be present, additional coal may have to be burnt under the boiler for the purpose of raising steam; and in this fashion the efficiency over all may be diminished. On the other hand, if too little dioxide and too much monoxide occur in the generator gas, too much heat may be carried to the boiler, and the over-all efficiency reduced by imperfect regeneration.

Thus it follows that when the steam-boiler of a water-gas installation is so designed that the heat of combustion of the carbon monoxide in the generator gas can be properly utilized, even if the proportion of that gas is low, and when the regenerator which heats the boiler-feed water by means of the sensible heat of the water gas is efficient, then the whole plant will be efficient, provided the loss of heat by radiation is not out of proportion to the capacity of the plant; and it will be of no consequence from a comprehensive point of view whether there is more than 13 per cent. or less than 12 per cent. of carbon dioxide in the gas which comes away from the generator during the blast.

ELECTRICAL DISTRIBUTION OF POWER IN GAS-WORKS.

By W. A. Baehr, of St. Louis.*

[A Paper presented at the Annual Meeting of the American Gaslight Association.]

During the past five years, much has been written regarding the economy of steam-turbines and gas-engines over steam-engines for power plants; but, so far as the writer knows, no one has yet discussed the gas-engine as a driver of electric generators for conditions existing in a typical American gas-works. However, I wish to refer you to an excellent paper, entitled "The Steam Consumption in a Water-Gas Plant," by Mr. Alten S. Miller, published in the "Proceedings of the American Gaslight Association" for 1899, in which a short discussion of a steam-driven electric power plant in a water-gas works is presented.†

The object of the present paper is to show by actual test the steam consumption of a typical gas-works under normal conditions, and to prove the economy to be gained by the installation of a local gas-engine driven electric plant, replacing certain steam-engines and steam-pumps by others which can be practically operated by electric motors. The writer has endeavoured to prepare a paper which will not only appeal to the members because it is more than a mere theoretical presentation of the case, but contribute its mite towards directing attention to that most promising of all modern prime movers, the gas-engine. We can not only successfully put up gas-engines to reduce our station costs, but at the same time may also educate others to appreciate the value of these machines.

The plant selected for the tests is that known as Station A of the Laclede Gas Company, St. Louis, and probably represents the typical gas plant, in that it consists of a water-gas department of 8 million cubic feet, and a coal-gas department of 3½ million cubic feet, daily capacity. This station, which was originally built in 1848, was rebuilt from time to time; but portions of the old apparatus still survive, in form at least. The plant thus represents in a measure the rapid strides that have been made in gas-making apparatus, from the old hand-fired benches of threes of 1848, to the modern 11-feet water-gas sets of 1903, all in operation at this date. The plant equipment is, therefore, not modern, but typical, as the results will show.

The station has one main boiler plant, consisting of six 225-horse power Heine water-tube boilers, four of which are operated in the autumn season. From these the steam is fed some 200 feet through the water-gas department to two simple non-condensing "Ideal" engines, driving the blowers supplying the water-gas blast; the exhaust steam heating the feed water for the boilers. Another branch of steam-pipe runs some 700 feet in the opposite direction, and supplies on its way boiler feed, tar and ammonia pumps, seven exhausters, and four high-pressure blower-engines. It also heats buildings and the holder during the winter months. The steam-piping is mostly 6-inch, and is covered with 85 per cent. of magnesia. It is erected out of doors for some 200 feet of its length. The steam consumption of each engine and pump was found by condensing the exhaust steam in a surface condenser, and allowing it to flow in one of two tanks, where it was carefully weighed. This was also done with all steam-traps and drains along the lines of pipe. The results of the tests, which constitute the valuable feature of them, are best summarized in the tabular statement on next page.

The column "Total Energy in Steam" represents the British thermal units put into the steam from 8° Fahr. feed-water temperature to 120 lbs. gauge pressure, and which leaves the boiler during 24 hours. The column "Energy Delivered by Machines" shows the theoretical work done by the various pieces of apparatus, and is derived as follows: For the "Ideal" engines the work done in the cylinder was calculated from indicator cards and converted into British thermal units. For the exhausters, the gas was metered and the pressures recorded; thus the work done was calculated. In figuring the high-pressure blower-engines, we assumed 40 per cent. slip on the blower, and kept the bye-pass closed during the test. In the pump test, the liquids were actually measured, and the pressures pumped against duly recorded, except in the case of the boiler-feed pumps, where the water-meter readings were taken.

Of course, the temperature of the condensed water in all cases was accurately measured. We found the total water evaporation in 24 hours from the water-meter readings; the meter being placed on the cold-water inlet to the feed-water heater. The exhaust steam from the "Ideal" engines passes through this feed-water heater; and to the total water-meter reading for 24 hours we added one-eighth of this meter reading, because we found from the water temperatures that it took 1 lb. of exhaust steam to heat very nearly 8 lbs. of feed water from 80° Fahr. to feed-water temperature. The heater did not run over during the test—the float-regulating valve being in perfect order; and no water was wasted into the sewer. Our city water pressure averages 25 lbs. per square inch.

The steam used in the water-gas generators was found by subtracting the amount resulting from the remaining apparatus from the total evaporation in 24 hours; and it thus includes the leakage and unaccounted-for steam. Since all the foregoing tests could not be made in one day, we simply averaged all the works results for the total period over which they extended. No single test period was less than eight, nor more than 26 hours. The table plainly shows the steam distribution among the water-gas, coal-gas, and mixed-gas departments. The low efficiency in all cases is probably due to the long steam lines—that is, wet steam. Thus, coal-gas exhauster No. 1 requires almost as much steam per 1000 cubic feet as the two water-gas exhausters, though the engine has a smaller cylinder and higher loading. The cost of steam is based on the present boiler-room costs of labour and material.

The column "Total Motor Efficiency" represents efficiency of transmission and conversion from the switchboard to the outlet of the exhauster or pump; and upon it is based the kilowatt-hours required. The column "Kilowatt Hours Required" is derived from the column "Energy Delivered by Machines in B.T.U." divided by the efficiency, and, of course, converted into energy units. In further explanation of the column "Total Motor Efficiency," I will say that we figured these as follows: In the case of the "Ideal" engines, we could supplant these by electric motors, and, by direct connection to the fan-shaft, eliminate the mechanical losses in the engines and the loss in the belt-drive, which together are about 10 per cent. The efficiency from the switchboard to the motor shaft would be at least 80 per cent., which would partly offset the 10 per cent. gain

* Mr. Baehr is Chief Engineer of the Laclede Gas Company; and his name will doubtless be remembered by our readers in connection with his interesting article on "High and Low Pressure Distribution Methods at St. Louis" which appeared in the "Journal" for July 19 last.—Ed. J.G.L.

† See "Journal," Vol. LXXIV., p. 1373.

Nature of Appliance.	Distance from Boilers in Feet.	Steam Used per 24 Hours, in Pounds.	Amount Pumped per 24 Hours.	Steam Used per 1000 Cubic Ft. of Coal Gas Made, in Pounds.	Steam Used per 1000 Cub. Ft. of Water Gas Made, in Pounds.	Steam Used per 1000 Cub. Ft. of Mixed Gas Made, in Pounds.	Total Energy in Steam above 80° Fahr., in B.T.U.	Energy Delivered by Machine, in B.T.U.	Efficiency per Cent. Ratio of two Preceding Columns.	Head Pumped against, in Pounds.	Cost of Steam per Day.	Total Motor Efficiency.	K. W. Hours per Day Required.	Cost of Electric Current at 1 cent per K. W. H.
Simple "Ideal" Engine	..	144,000	..	..	25·8	..	164,160,000	†12,000,000	7·30	0·9	$40·32	90	3600	$36·00
Water gas exhauster	230 to 60 / 1 ,, 125	37,962	5,586,000 cub. ft.	..	6·8	..	43,277,000	719,000	1·66	0·7	10·63	70	300	3·00
Coal gas exhauster No. 1	700	16,966	1,336,000 ,,	12·70	..	..	19,341,000	148,500	0·77	0·6	5 75	70	62	0·62
Do. No. 2	90	5,609	790,000 ,,	7·10	..	..	6,394,000	88,000	1·38	0·6	1·57	70	36	0·36
High-pressure blower No. 1	390	50,297	2,775,000 ,,	..	..	18·10	57,339,000	2,100,000	3 66	4·1	14·08	70	878	8·78
Do. No. 2	400	50,297	2,775,000 ,,	..	..	18·10	57,339,000	2,100,000	3·66	4·1	14·08	70	878	8·78
Boiler-feed pump	20	21,916	477,400 lbs.	..	..	2·90	24,984,000	172,000	0·69	120·0	6·13	.	..	..
Tar-pump	.. / 60	280 / 3,200	2,800 gals. / 32,000 ,,	.. / 1·60	0·06 / ..	.. / ..	.. / 3,967,000	.. / 60,000	.. / 1·51	.. / 30·0	.. / 0·98	.. / ..	.. / ..	.. / ..
Ammonia pump*	50	510	10,205 ,,	0·24	..	..	581,400	3,830	0·66	15·0	0·15	60	2	0·02
Water gas oil-pump*	240	4,500	26,215 ,,	..	0·80	..	5,130,000	17,450	0·34	30·0	1·26	60	8	0·08
Trap No. 1 (engine-room)	220	1,382	5,586,000 cub. ft.	..	0·25	..	1,575,000	..	..	..	0·39	..	..	..
Do. No. 2 (new retort-house)	650	1,872	1,336,000 ,,	1·40	..	..	2,134,000	..	..	..	0·43	..	..	..
Do. No. 3 (high-pressure engine-room)	360	779	7,712,000 ,,	..	..	0·10	888,000	..	..	..	0·22	..	..	..
Steam used in water-gas generator	50 to 200	137,830	5,586,000 ,,	..	0·25	..	..	..	..	..	38·64	..	..	..
Total	..	477,400	..	23·04	58·71	39·20	387,109,400	17,408,780	..	..	$144·63	..	5764	$57·64

* In use f r only 10 per cent. of the total time.

† This figure is not "energy delivered," but is actual work done in the cylinder.

above, and leave a certain net efficiency of about 90 per cent., as given in the table. This appears high because it is figured back to the theoretical work done in the engine cylinder. In the same way we figured the actual motor efficiency from the switchboard to the outlet of the exhausters and blowers as follows:

	Switchboard Output.
Line loss	3 per cent.
Actual motor loss	15 ,,
Mechanical losses in connecting devices (such as silent chain)	5 ,,
Losses in the machines	7 ,,
Total	30 per cent.

In the case of the electrically-driven pumps, I feel we are safe in assuming their efficiency to be at least equal to 60 per cent. of the switchboard output. From the table, it will be seen that the total steam cost per day is $144·63. In installing electricity, we would drive only such machines with motors as have been enumerated in the column of electric costs. It should be understood that we already use electric motors for driving machine tools, elevators, various pumps, cooling tower fans, &c., and electricity for lighting the plant. This current is derived from our electric plant, situated about 2 miles from the station. It amounts to 1440 kilowatt-hours per day, with a demand of 105 kilowatts. From the column "Kilowatt Hours per Day Required," we have 5764 kilowatt-hours per day on a demand of 261 kilowatts. This makes our total current consumption 7204 kilowatt-hours on a possible demand of 366 kilowatts. It is not reasonable to suppose that this maximum will occur; but we will make provision for it, as we shall undoubtedly be able to use a little excess capacity in the course of time. From the total consumption of 7204 kilowatt-hours per day we derive our average load of 300 kilowatts, all on the switchboard. In figuring the demand of 261 kilowatts, it should be noted that the high-pressure blower-engines require 878 kilowatt-hours per day, when pumping against an average gas pressure of 4 lbs. per square inch, whereas the maximum pressure is 5 lbs.

The steam costs, which would be affected by the electric installation, now amount to $87·84 per day; thus leaving $56·79 per day for the steam used in the water-gas generators, certain pumps, and that lost by condensation. Since a question might be raised as to the practicability of driving the coal-gas exhausters electrically, I will say that an ordinary float governor could easily be arranged to either actuate a rheostat or a valve in a bye-pass to the machine, and thus a fair efficiency be maintained. The long steam lines, low thermal efficiency, and the fact that the load is exceedingly variable on most of the engines, strongly recommend the electric motor drive, with its high efficiency and simple means of transmission, especially its high efficiency for variable loads as compared with the steam-engine. The conditions for loss by condensation were, at the time of carrying out these tests, such as to make them a minimum.

We have figured that there are only three feasible methods of driving the electric generators—namely, by using uncarburetted water gas from the generators, by manufacturing producer gas for a gas-engine drive, or by installing steam units, utilizing the capacity of the present boiler plant. If we attempted to use city gas in the gas-engines, the expense of running them rises considerably above the cost accruing from the producer or uncarburetted water-gas installation, and therefore we have omitted entirely the city gas calculation. But it must be borne in mind that the tabular steam costs are only the cost of material and labour in the boiler-room; whereas the electric rate of 1 c. per kilowatt-hour includes interest, certain depreciation, and some operating expenses. This method of calculation was purposely adopted to give an additional factor of safety for the argument in favour of the electric drive, and a more detailed explanation follows.

The uncarburetted water gas from the generators could be simply tapped off from the primary scrubbers and run into a separate relief holder. It might be necessary to add an air-blast with the steam for manufacturing this gas, as the pure uncarburetted water gas is very difficult to work in gas-engines. Four uncarburetted water-gas sets run every three hours from one of our 11-feet sets would provide all the gas needed for the power plant. Between the separate relief holder and the gas-engines a tar extractor or scrubber would be placed. The relief holder is figured to contain enough gas for about two hours' supply of the uncarburetted water gas, and about one hour's supply of producer gas. I realize that the large percentage of hydrogen in uncarburetted water gas renders high compression impossible; but I still feel that the given efficiency could be obtained by adding air if necessary, as above stated, or by improvements in the gas-engines themselves. The installation of producer gas could be either of the pressure or the suction type.

The steam system was calculated to consist of two compound steam-engines, connected direct to "D.C." generators, and having added the necessary condensers, &c., and using steam from the present boiler plant. We did not consider the steam-turbine, since no existing type allows of direct connection to "D.C." generators in this size, on account of the high rotative speed. We selected 220-volt three-wire "D.C." distribution because there is so much variable speed work at our plant that "A.C." motors at present are practically out of the question. We chose multiple-voltage three-wire distribution because the all-day efficiency would be about 10 per cent. higher for variations in motor loads from 50 to 100 per cent. The third wire is reckoned to be connected to the neutral point of an equalizing outfit or motor generator set. The maximum voltage of 220 is not dangerous to life. The 110 or 220 volt motors are built of slow-speed type, well adapted for the various uses we require; and either voltage can be used for lighting. This system works out very well for balancing loads at all times, and thus maintaining the highest efficiency.

Gas Costs.—From careful estimates, we should be able to manufacture this gas for from 7 c. to 9 c. per 1000 cubic feet; and in our calculations we have used 8 c. as its cost.

Producer Gas.—I will not attempt to calculate the costs of all kinds of producer gases, but take the statements of the manufacturers as being correct, making due allowance for lack of efficiency, loss of bye-products, &c. Messrs. R. D. Wood and Co., in their pamphlet on "Mond Gas," state that "the cost of Mond gas, when produced on a large scale, is less than 1 c. per 1000 cubic feet." In order to be safe, I have assumed that we could produce such gas at 3 c. per 1000 cubic feet, and have taken its calorific value at 125 B.T.U. per cubic foot.

Steam Costs.—These are simply the costs as they exist in our boiler plant to-day.

With the foregoing facts in mind, the following three tables

show the installation cost and yearly expense of the three power systems assumed:—

Gas-Engine Plant Using Uncarburetted Water Gas.

	First Cost.
One 30,000 cubic feet relief holder	$5,000
Foundations, connections, scrubber, valves, &c.	5,000
Building, 40 ft. by 100 ft. by 25 ft., at 7 c. per cubic foot	7,000
Two 500-horse power gas-engines and foundations	40,000
Two 400-kilowatt "D.C." generators	7,000
Two 75-kilowatt motor generators	3,400
Switchboard	6,000
Wiring	3,600
Small piping, air compressor, and sundries	3,000
Two 200-horse power motors	4,500
Eight 75 ,, ,,	9,000
Three 50 ,, ,,	2,700
Small motors and pumps	2,300
Total	$98,500

Say, $100,000. A certain operating expense for one year, at the average load of 300 kilowatts at the switchboard (gas consumption efficiency = 13,000 B.T.U. per brake horse-power-hour = 40 cubic feet per brake horse-power-hour, at 8 c. per 1000 cubic feet) would be—

Cost of gas, 400-horse power	$11,212 80
Oil, waste, packing, &c.	2,000·00
Interest and depreciation, at 10 per cent.	10,000·00
Total	$23,212·80

This equals 0·88 c. per kilowatt-hour generated. With an electric generator efficiency of 90 per cent., this figure becomes 0·90 c. In regard to labour, I may say that we can dispense with enough engineers to offset any additional men who would be required in the power plant. Thus no extra charge appears for this item.

Here I wish to call your attention to the method of estimating the costs above. It is absolutely necessary that you should bear in mind that the figures are comparative ones only, not actual totals. For instance: (1) The certain operating expense does not include labour, superintendence, sundry expenses, &c., because these would be practically the same as for the present equipment. (2) I have figured interest at 5 per cent. (3) I estimate that depreciation for this kind of plant should not be taken at less than 10 per cent. As it is impossible to arrive at the exact rate of depreciation and maintenance to allow on our present steam equipment, I have assumed that I can reckon 5 per cent. depreciation on the new plant, and thus practically offset the lack of depreciation and maintenance charges against the old one. For this reason I have assumed interest and depreciation at 10 per cent.

Gas-Engine Plant Using Producer Gas.

	First Cost.
One 500-horse power producer plant	$15,000
One 30,000 cubic feet relief holder	5,000
Foundations, piping, &c.	5,000
Building, as before	7,000
Two 500-horse power gas-engines and foundations	40,000
Two 400-kilowatt "D.C." generators	7,000
Two 75-kilowatt motor generators	3,400
Switchboard	6,000
Wiring	3,600
Small piping, air compressors, and sundries	3,000
Two 200-horse power motors	4,500
Eight 75 ,, ,,	9,000
Three 50 ,, ,,	2,700
Small motors and pumps	2,300
Total	$113,500

Say, $115,000. A certain operating expense for one year, at the average load of 300 kilowatts at the switchboard (gas consumption efficiency = 13,000 B.T.U. per brake horse-power-hour = 104 cubic feet per brake horse-power-hour, at 3 c. per 1000 cubic feet) would be—

Cost of gas, 400-horse power	$10,932·48
Oil, waste, packing, &c.	2,000·00
Interest and depreciation, at 10 per cent.	11,500·00
Total	$24,432·48

This equals 0·93 c. per kilowatt-hour generated. With an electric generator efficiency of 90 per cent., this figure becomes 0·95 c. In this, as in the foregoing case, we reckon that the labour charges will offset each other. The producer plant is assumed to be a Mond gas outfit, and includes piping, foundations, &c., but no holder or bye-products apparatus.

Steam-Engine Plant.

	First Cost.
Building, 40 ft. by 80 ft. by 25 ft., at 7 c. per cubic foot	$5,600
Two horizontal cross-compound Corliss engines, 500-horse power, at $18 per horse power (generator connected direct)	18,000
Two 400 kilowatt "D.C." generators (costs more than previous ones because of slower speeds)	10,000
Foundations and piping	8,000
Condensing apparatus	6,000
Cooling tower, complete	5,000
Two 75-kilowatt motor generators	3,400
Switchboard	6,000
Wiring	3,600
Two 200-horse power motors	4,500
Eight 75 ,, ,,	9,000
Three 50 ,, ,,	2,700
Small motors and pumps	2,300
Total	$84,100

Say, $85,000. A certain operating expense for one year, at the average load of 300 kilowatts at the switchboard, would be as given below. The steam consumption was figured at 15½ lbs. per brake horse-power-hour at full load, and 20 per cent. more, or 18·6 lbs. per brake horse-power-hour, at three-quarter load. Adding 1·4 lbs. for auxiliaries and condensation, we have 20 lbs. total steam per brake horse-power-hour.

Steam cost—400-horse power, at 20 lbs. per hour, at 28 c. per 1000 lbs.	$19,622·40
Oil, waste, packing, &c.	2,000·00
Interest and depreciation, at 10 per cent.	8,500·00
Total	$30,122·40

This equals 1·145 c. per kilowatt-hour generated. With an electric generator efficiency of 90 per cent., this figure becomes 1·23 c. The labour charges are treated as previously. The 28 c. per 1000 lbs. of steam generated is our present boiler-room cost.

From the foregoing figures, it appears that we are safe in taking a kilowatt-hour covering the items under consideration as costing 1 c. additional, if gas-engine power were used; and while the first cost of a gas-engine plant is higher in our case than that of a steam plant, there is a considerable saving per year to be effected with it over the steam installation. Besides, our boiler plant has a maximum pressure capacity of 120 lbs. per square inch; and as it operates on the water-gas sets, considerable fluctuations in the steam pressure occur. No superheating surface exists at present; and the boilers throw some water, which would materially affect the economy of a steam plant. The gas-engine has also other considerations for economy, in that the all-day efficiency of the water-gas plant might be brought up by using the first runs after clinkering and coaling up for an uncarburetted gas run for the gas-engine, or if the carburettor is not up to heat by making several such runs. While a considerable number of experiments along these lines may be necessary, there certainly appears to be an opportunity here of using poor water gas runs to good advantage. Of course, the adoption of a producer plant would not allow this. As regards the alleged unreliability of gas-engines, I merely call your attention to the duplicate outfit proposed, and to the many thousands of horse power of such prime movers in successful daily operation in England and on the Continent, ranging in size up to units of 2000-horse power.

From the table we have the following figures:—

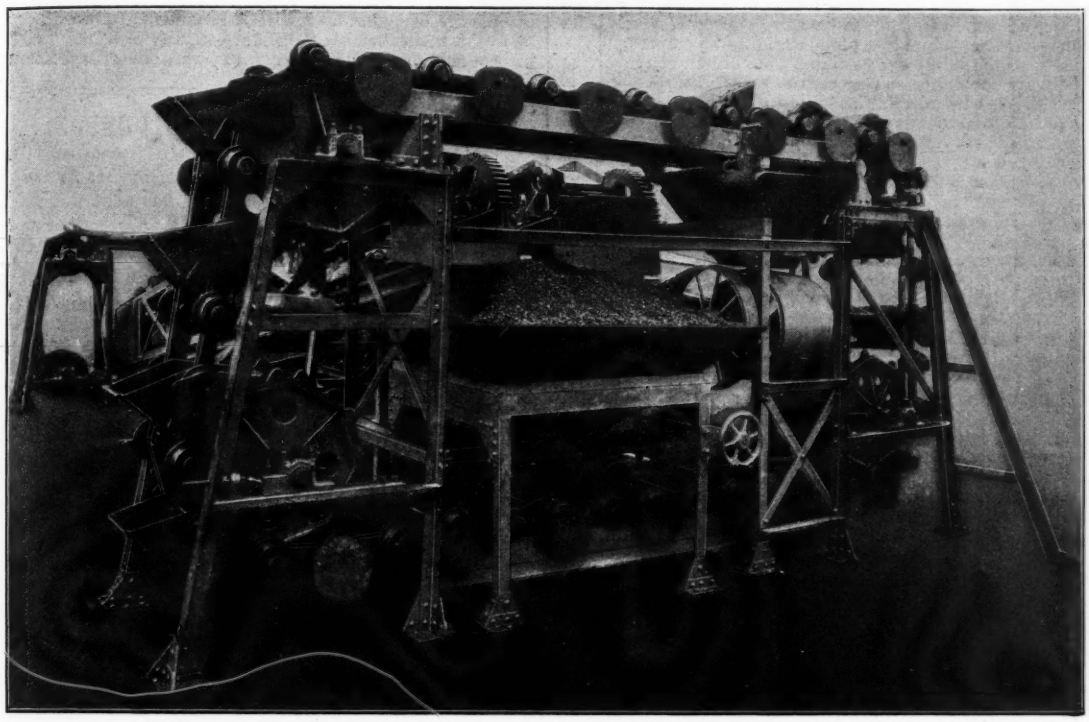
A certain cost per day, old steam system	$87·84
The comparative cost per day of electric power, at 1 c.	57·64
Saving per day	$30·20
,, ,, year	$11,023·00

To this must be added the saving we should effect by getting the current we now use at the gas-works at the new rate as against the present one. Yet we can scarcely call this a saving, because the existing rate is an arbitrary figure between the two departments. It therefore appears that we should be able to save about $11,000 per year with the electric installation. Thus, without considering interest on the present steam system, the electricity driven plant, with interest and depreciation, pays for itself in from eight to ten years. It must also be noted that in the table the cost of operation of the present system is simply that of generating the steam, no account being made of supplies; and besides this, the maintenance of the long steam lines, with their numerous valves, expansion joints, &c., requires considerable attention and repair.

Having adopted, as I believe, a reasonable estimate of first cost and cost of operation, with the above considerations in addition, I submit to your judgment the fact that an economy in our power costs of more than 30 per cent. may be obtained by operating this station electrically with a gas-engine-driven electric power plant.

Output of British Minerals Last Year.—The third part of the General Report on Mines and Quarries for 1903, recently issued by the Home Office, gives generally and in detail the amount and value of the minerals produced. The introductory summary shows that the total value of the minerals raised during the year amounted to £101,808,404—a decrease of £5,296,480 as compared with 1902. This is to be accounted for by the fall in the average price of coal from 8s. 2·84d. per ton in 1902 to 7s. 7·93d. per ton in 1903. The total output of coal was the highest hitherto recorded—viz., 230,334,469 tons; but the value was only £88,227,547, against £93,521,407 in 1902, when the output was less by more than 3 million tons. The quantity of coal exported, exclusive of coke and patent fuel and of coal shipped for the use of steamers engaged in foreign trade, was 44,950,057 tons—an increase of nearly 2 million tons on the exports for 1902. Germany, France, and Italy each received more than 6 million tons, Sweden more than 3 millions, and Russia, Spain, Denmark, and Egypt each upwards of 2 million tons. Adding the 2,055,444 tons exported in the form of coke and patent fuel, and the 16,799,848 tons shipped for the use of British and foreign steamers engaged in foreign trade, the total quantity of coal which left the country was 63,805,349 tons. The amount remaining for home consumption was 166,529,120 tons, or 3·930 tons per head of the population. Among the non-metallic minerals, the increase in the output of natural gas at the Heathfield workings from 150,000 to nearly a million cubic feet is recorded.

A UNIQUE COMBINATION OF CONVEYORS.

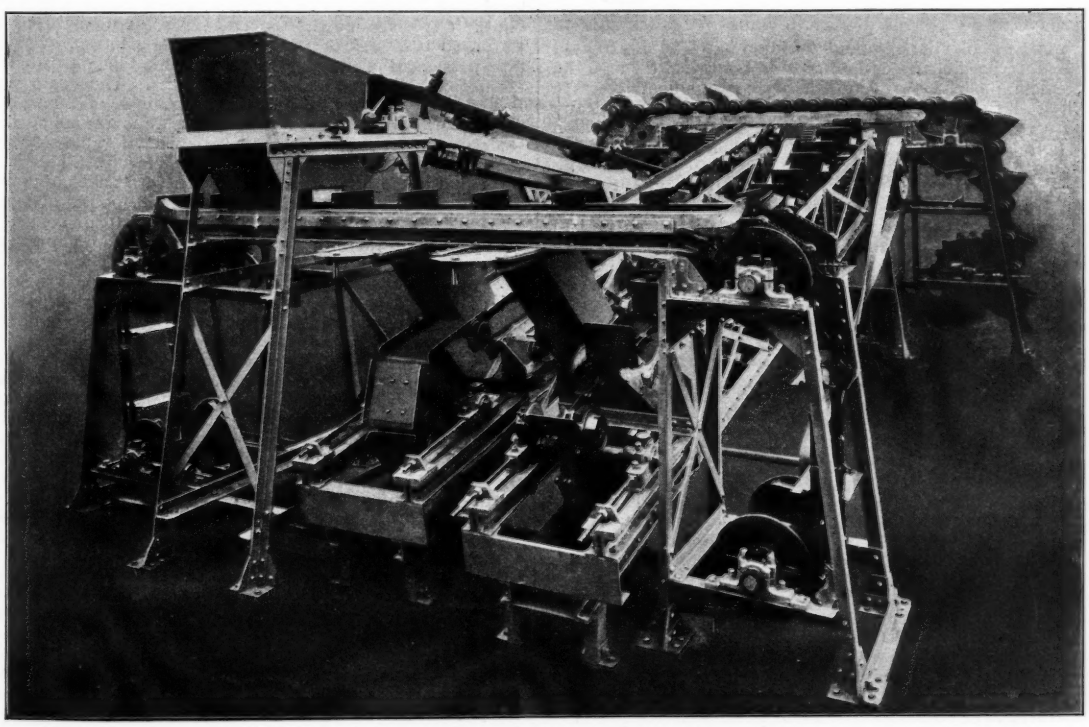


View Showing the Coal Feeding Hopper.

When the Earl's Court Exhibition opens next Saturday, it will be found that Messrs. Graham, Morton, and Co., Limited, have provided a novel exhibit—embodying five different designs of conveyors, applicable for handling coal and other heavy material. The original idea of the design has been carried out in its entirety, whereby the coal is continually and automatically passing round the whole of the plant, and through each portion of the apparatus.

The plant may be described as follows: It is self-contained, and is entirely of steel structural work, and standard sizes of conveying plants. There is a receiving hopper at one corner, which automatically feeds the gravity bucket conveyor. The speciality in this design of conveyor is that it is overlapping, and therefore is very easily fed by means of a spout, so that there will be no spilling of the coal or other material over the sides of the conveyor. Several large installations of this design have been erected for electric power houses—one of the most important being at the Neasden power station of the Metropolitan Railway Company. These gravity bucket conveyors are also made with separate buckets, fed by means of a revolving filler.

The advantage of this design of conveyor is the small amount of horse power required to drive them; but in gas-works the saving of steam is not always a stringent drawback to the introduction of labour-saving appliances, as breeze, dust, &c., are



View Showing Five Different Types of Conveyor.

easily converted by means of forced draught. This overlapping gravity bucket conveyor carries the coal overhead, and delivers it into a Graham's patent rubber belt conveyor. The principal features of this rubber belt conveyor are the small amount of horse power required to drive it, the long length of belt which can be utilized for the conveyors, and the varying speeds at which belts can be driven to accommodate the material to be carried.

It is interesting to fully examine this class of belt conveyor, as it is largely applicable for storing coal in gas-works. The coal is thrown off the belt by means of a tripper carriage, so designed that it can be automatically moved along the whole range of coal stores or tanks by the motion and power of the belt itself; and it can be arranged so that in automatically feeding bunkers or tanks, directly the bunker is filled the coal passes on to the next bunker This class of conveyor is very easily erected, and accommodates itself to Colonial work, as it can be readily packed and fixed upon. timber packings.

From this conveyor, the coal is delivered on to a continuous double-sided push-plate conveyor, the novelty of which is that it can be utilized at the top and bottom as two push-plates, and thus perform a double function. The firm, some five years ago, erected a large conveyor on this principle at the Leeds electric light works for filling the coal-stores and automatically emptying them. This was done by means of shoots from underneath the coal store, delivering into the lower trough of the conveyor.

The system of filling and automatically emptying coal-stores absolutely completes the cycle of coal handling; and the makers inform us that it is exactly the same cost for labour to fill and empty a coal-stores as it is to fill a coal-stores only. They point to a splendid example of this at the Nanterre Gas-Works, where the whole of the labour from taking the coal from the boat into the coal-stores, and automatically from the coal-stores into the bunkers of the retort-house only costs 1d. per ton.

The conveyor shown delivers the coal into two other designs of conveyors—viz., the tray conveyor and push-plate conveyor. The tray conveyor is largely used for coal, coke, and other heavy materials, and is formed of overlapping plates. This design of conveyor can either be made on rollers, or similar to the standard picking-belts which the firm manufacture and introduce largely into collieries. The push-plate conveyor erected has the push-plates supported by roller wheels, and is similar to those erected by the firm for the Gaslight and Coke Company at their Fulham and Bow Common works. The design is on similar lines to the gravity bucket conveyor except that there will be a little extra friction due to the scraping of the coal along the trough. This is, however, not excessive when handling coal. The firm also make push-plate conveyors with their skidder bars arranged to run along greenheart liners, which are very successful and last many years.

With reference to the general design of this unique plant, we can highly compliment Messrs. Graham, Morton, and Co. on giving gas engineers such a good example as this combined exhibit of conveying plant affords.

PYRIDINE BASES IN AMMONIA.

Dealing recently with the above subject in the "Zeitschrift für analytsche Chemie, Herren J. Milbauer and V. Stanek showed that if a mixture of ammonia and pyridine (C_5H_5N) be treated with calcium chloride, and carbon dioxide be passed through the liquid, calcium carbonate ($CaCO_3$) and ammonium chloride (NH_4Cl) are formed, while the pyridine, which does not form any carbonate, remains free. The reaction proceeds similarly when salts of both bases are treated with milk of lime ($Ca[OH]_2$), and carbon dioxide is passed through the mixture. The aliphatic amines—*e.g.*, methylamine, ethylamine, &c.—behave like ammonia. The pyridine is then extracted by means of ether. It may be remarked, in connection with the authors' work, that in the distillation of the ammoniacal liquor of gas-works for the manufacture of sulphate of ammonia, pyridine is often liberated, and its presence made manifest to the senses by the sickly smell that arises from the oxide of iron purifiers when no sulphuretted hydrogen is escaping. It is therefore highly desirable to be able to ascertain the quantity of pyridine present in the liquor, and to learn whether or not it will pay for extraction, as this tar base commands a good price for use in the denaturing of alcohol and other purposes.

In more precise detail the authors recommend a method on the following lines, in order to ascertain the pyridine bases (1) in ammonia and (2) in ammonium salts: (1) From 100 to 200 cc. of commercial ammonia are diluted with an equal volume of water, and poured into dilute sulphuric acid, to which a few drops of a 1 per cent. aqueous soluion of "Patent blue V N Superfine" have been added. The strongly acid solution is evaporated nearly to dryness, brought into a separating funnel, a sufficient quantity of a freshly prepared sodium bicarbonate solution and an equal volume of ether added, and the whole agitated for from 10 to 15 minutes. (Pyridine does not form any carbonate.) After drawing off the layer of ether, fresh ether is added, and the whole again shaken as before. The united ethereal solutions of the pyridine bases are filtered through a filter moistened with ether, the filtrate treated with a few drops of patent blue solution, and thoroughly shaken up with N/10 sulphuric acid. The liquid thus acquires a yellowish-green tint. Subsequently excess of sodium chloride is added, and the liquid titrated back with N/10 caustic soda solution till a blue tint is produced—the change being distinct and rapid. The authors recommend shaking a third time with ether, to prove that no more pyridine remains behind. (2) From 50 to 100 grammes of the finely powdered sample are placed in a separating funnel, treated with 25 to 30 cc. of water, neutralized, a sufficient quantity of solution of sodium bicarbonate added, and the process above described followed.

TAR OILS FOR HEATING PURPOSES.

An article dealing with this subject, by M. A. Rispler, of Schoonaerde, near Ghent, in Belgium, has been published in a recent number of "Chemiker Zeitung." The author says that, at a time when so much is heard about heating with petroleum, it is appropriate to discuss also the use of tar oils for this purpose. Though these oils have been applied for many years, the results obtained with them have commonly been kept quite secret. For instance, experiments have been tried with them in the Austrian Navy for heating the boilers of torpedo boats, where the high flashing point, 95° to 105° C., of the heavier tar oils gives them the advantage over the readily inflammable petroleum that in warfare they would be less likely to be ignited by exploding shells. In industrial works, and tar-works in particular, certain tar oils are frequently used as fuel.

M. Rispler goes on to discuss the financial aspect of the application of tar oils for heating purposes. On the large scale, and over a period of several months, it has been found that 100 lbs. of tar oil are equivalent to 200 to 220 lbs. of good screened coal. Thus the tar oil must not cost, per ton, more than 2 to 2·2 times as much as such coal, in order that it may be applicable for heating purposes. From this datum, any one may calculate, on the basis of the prevailing cost of coal, how great a saving can be effected by the use of tar oils. The most essential condition of the economical utilization of tar oils as fuel is the use of a suitable fire-box. The chief advantage of liquid over solid fuel lies in the rational combustion of the former. The combustion of liquid fuels can be precisely regulated; whereas with solid fuel much is lost through the excess of air required and the lapses of the stokers.

The combustion of tar oils is effected by injecting them, by means of steam, through an atomizer in a jet of very fine drops into the furnace, where they burn. The heat developed is very great, and thus the iron plates of the heated vessels suffer. With Cornish and Lancashire boilers, the tubular flues should be protected by a fire-brick lining as far as the flame penetrates. With stills, burning of the bottom plates is not so likely, as the bottom is usually protected by an arch or is dumped up so that the flame is spread out. The grate itself is done away with, being covered by a wrought or cast iron plate, which shuts off the ash-pit so that the air supply does not reach the flame from below. The air required for combustion must pass through holes in the furnace door direct to the atomizer, so that excess can be avoided and good combustion attained,

The general arrangement of apparatus for oil-firing, as described by M. Rispler, is that an oil-tank is placed about 5 feet above the level of the atomizer. In this tank, which contains the store of oil, there is a steam coil of several turns, for maintaining the oil warm, so that any crystals are kept in solution. The steam-pipe passes out of the bottom of the tank, takes a turn through the fire-box, and then enters the atomizer. The steam is superheated and dried in the loop of the pipe in the fire-box, and this ensures uniformity of combustion. There is a small cock on the steam-pipe, just as it enters the atomizer, for blowing off condensed water when the furnace is being started. The oil passes through a pipe to the atomizer, which is set at a slight inclination towards the fire-plate, in order to avoid the points of flame impinging directly on the bottom plates of the still or boiler. There are openings in the furnace door, provided with dampers for controlling the air supply to the furnace, and valves for regulating the passage of steam and tar oil.

At starting, a wood or coal fire is lit in the fire-box, and steam is allowed to blow through the pipe and off at the condensation relief cock. As soon as the tar oil in the tank is warm, and the steam is dry, this cock is shut, and the steam passes on to the atomizer, while the oil-valve is at the same time opened. The steam breaks up the stream of oil, which ignites at the fire, and produces a long and powerful flame. The inflow of oil and steam is so regulated that the flame is not smoky. Once the oil is burning properly, nothing more has to be done except to regulate the supply of oil and steam to vary the size of the flame according to the immediate requirements.

Anthracene sludge can also be used by means of the arrangement described; but in order to avoid blocking of the oil-pipe through deposition of crystals, the steam-pipe is run close alongside the oil-pipe, and an insulating jacket is put round them, so that the oil-pipe is kept warm and crystallization prevented.

For heating tar-stills, &c., the oil fuel has the advantage over coal that, by admitting of more precise regulation of the size of the flame, it facilitates a steady distillation of the contents of the still. M. Ripsler has found oil firing specially advantageous for fractionating crude carbolic acid, as it affords much better and more regular working of the still. The brickwork of a furnace suffers less with oil fuel than with coal.

THE VALUATION OF GAS COALS.

A recent number of "Glückauf" contained a communication by Herr Bertelsmann on the "Determination of the Value of Gas Coals." He points out that the matter is of great practical importance to both the collieries and the gas-works, and that the price of coal ought to be governed by its actual value as a gas-producing material. But elementary analysis affords no criterion of this value, which can only be determined by a gas-making trial in large retorts under the conditions which prevail on gas-works. Formerly, the sperm value of the coal was calculated from the yield of gas and its illuminating power as developed in the argand burner; but as only 10 per cent. of the gas consumed is now burnt in self-luminous flames, this sperm value has ceased to be of practical significance. The determination of the calorific power of the gas has become more important, and the coke and ammonia produced, as well as the behaviour of the coal on distillation, have to be taken into account. The author then refers to Herr Drehschmidt's determinations, recently reported in the "JOURNAL" (Vol. LXXXVII., p. 460), and comments upon them. He concludes that the German coals are superior to the English in respect of the rapidity and ease with which they carbonize. The English coals, broadly, however, yield more ammonia. On the other hand, Westphalian coal produces gas containing only half as much sulphur, other than sulphuretted hydrogen, as the gas from English coals. In order, however, that the German coals may succeed in entirely superseding English gas coals in German gas-works, the collieries will have to take steps to reduce the proportion of ash, especially in the Westphalian output.

USE OF TAR FOR ROAD SURFACES.

The "Annales des Conducteurs des Ponts et Chaussées" recently contained some reports on the above subject by French engineers; and the following particulars may be of interest.

M. Heude, the Chief Engineer for the Department of the Seine-et-Marne, considers that the tarring of roads cannot produce satisfactory results unless the tar penetrates between the joints in the road. The road must therefore be laid quite bare by sweeping it, in order to clear away all dust, and leave the stones a little in relief. Another point is that the tar must be very fluid. M. Sigault, another member of the engineering staff, states that in the *arrondissement* of Meaux all the roads treated with tar remained in good condition until the end of last year, free both from dust and mud. It was not until the present year that mud began to appear; and it was usually about the month of March, after fogs and thaws. Some of the tarred roads are still in perfect order, though generally the tar has been more or less worn in the centre; but, on the whole, they had deteriorated at the end of last winter to the extent of nearly 50 per cent.

These examples show that, even in places where the tar did not resist to the end, it nevertheless did good service, either by decreasing to a considerable degree the amount of mud and dust, or by preventing the wear and tear of the road. But, notwithstanding its undeniable advantages, the tarring of roads is not, according to M. Sigault, likely to be adopted on an extensive scale. In the first place, it will soon be restricted by lack of material; and, secondly, tarring is a very expensive operation.

Experiments in the *arrondissement* of Melun demonstrated, according to M. Imbs, another engineer, that the effect of tar on parts of the road over which there is great traffic, especially motor cars, seems to be of very limited duration. One of the more permanent advantages is the great decrease of mud. This is more conspicuous than the absence of dust on a road tarred six months previously. As soon as the road is washed by heavy rain, the dirt is carried into the gutters, and the coat of tar is useful in preventing dust. In dry weather, on the other hand, the dust brought by the wind and vehicles, and the refuse of all kinds thrown upon the road, are raised by the passing cars unless the road is frequently watered. M. Imbs regards the general results as good; but on the point of the eventual economy of tarring, he has not been able to make an estimate.

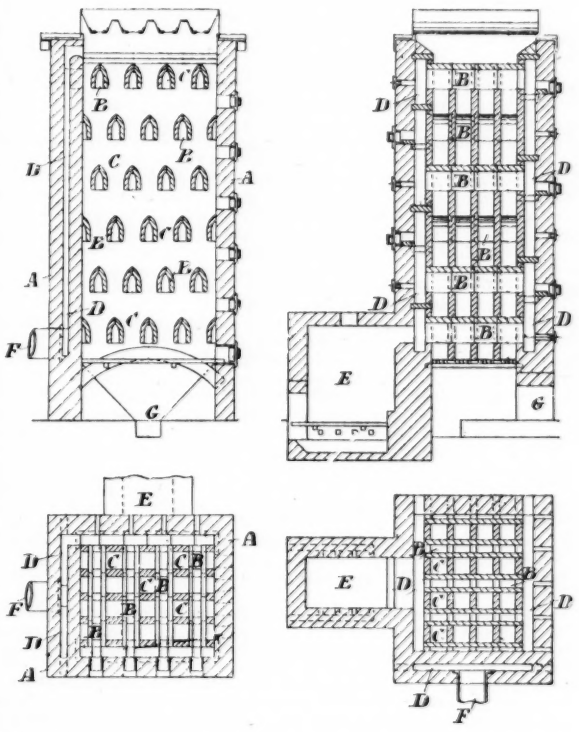
According to some particulars given by M. Bertrand, and quoted in the "Revue Industrielle," considerable differences were observed in the various sections of road treated in the neighbourhood of Fontainebleau, due to the state of the weather, the degree of wear and tear of the road, pools of water, and the condition of the fire employed for melting the tar. Work was executed from May 27 to Aug. 27; and, owing to the relatively low temperature, the proportion of heavy oil added to the tar varied from 1-30th to 1-15th. The cost price per square mètre (10·76 square feet) varied from 0·76d. to 1·14d.; and the consumption of tar from 2·138 lbs. to 3·8 lbs. The average cost price is made up as follows: Tar, 0·55d.; oil, 0·17d.; coke for heating, 0·02d.; labour, 0·23d.; brooms, &c., 0·03d.—total, 1d. Thus the average cost of 1d. per square mètre seems the true estimate for regular work; at any rate, it cannot be much less. The enemies of road dust should therefore reckon the average expense as £18 to £20 per acre of road to be tarred, without knowing whether or not the operation will have to be repeated the following year, or even before. The total area of road treated in these experiments was 23,000 square mètres, or about 27,508 square yards; and the length nearly 2½ miles.

REGISTER OF PATENTS.

Utilizing Gas Lime or other Calcium Compounds and Clinker, Slag, or other Silicious or Aluminous Material for the Manufacture of Cement or Moulded Articles.—Bond, J., of Southport. No. 23,213; Oct. 27, 1903.

This invention relates to a process "for chemically and physically combining gas lime and also other calcium compounds with clinker or slag, and with other compounds containing silica and alumina, thereby forming a material suitable for the manufacture of cement, bricks, tiles, slabs, and other moulded forms." The term "gas lime" includes all other calcium compounds, and the word "clinker" includes all compounds containing silica or alumina, or both.

The process consists of first mixing the gas lime and clinker together. The mixture is then ground (preferably moist) to incorporate the particles well together. It is then dried and subjected to the hot gases and heat of a specially constructed kiln or tower. In this kiln or tower, a large amount of the gas lime and clinker combines to form calcium silicate, alumina silicate, and aluminate of lime. There is also present calcium oxide, and a portion of calcium carbonate and other compounds of lime. These compounds are further mixed and ground with clinker and pressed into bricks, slabs, or other moulded forms, which are subjected to the action of steam in the presence of carbonic dioxide under pressure.

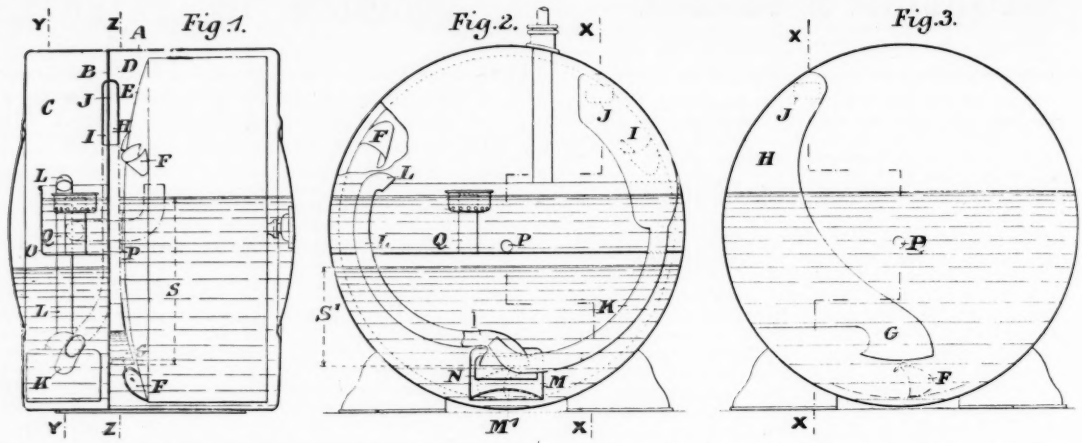


The kiln or tower consists (as shown) of an upright shaft A having a number of inverted V or U-shaped flues B placed in a horizontal position, and left open at the ends and bottom. They are preferably fixed alternately in sets throughout the whole height of the kiln or tower. There is a space C left between each of the flues to allow the gas lime or clinker to fall around and on the outer surface of the flues. The inverted flues B are connected with vertical flues D in such a manner as to allow the hot gases from a regenerative or other furnace E to travel along and from one set of flues B to another set in a zig-zag course through the tower or kiln. At the base of the kiln or tower a number of grooved or toothed shafts or other suitable revolving or jigging arrangement (not shown on the engraving) may be placed, to prevent the gas lime and clinker from falling through the kiln or tower in a too rapid stream.

The gas-lime and clinker are fed into the top of the kiln or tower by any convenient method, and are allowed to fall on or about and between the flues B in their passage down the kiln, and form the base of the flues. Consequently, the hot gases from the furnace come into direct contact with the gas lime and clinker. A fan or exhauster or chimney is connected to the outlets F of the kiln, and the hot gases from the furnace are thus drawn through the mixed material and the flues. G is the outlet for the removal of the material.

Automatically Maintaining a Constant Level of the Water in Gas-Meters.—La Société Industrielle des Compteurs, of Paris. No. 15,134; July 6, 1904. Date claimed under International Convention, March 7, 1904.

This apparatus is characterized by the employment of buckets mounted upon the exterior of the meter drum and serving to take up a certain quantity of gas at each revolution; "the gas being utilized for inducing a mechanical feed of reserve water contained in the hydraulic compartment of the meter and delivering the water in small quantities



at a time into the drum casing (which is provided with an overflow outlet), thus ensuring a continuous supply and the maintenance of the liquid in the casing at a constant level."

Fig. 1 is a longitudinal section of the apparatus on the line X of fig. 2. Figs. 2 and 3 are cross sections respectively on the lines Y and Z of fig. 1, showing the two faces of the partition separating the hydraulic compartment of the meter from the compartment containing the drum.

A represents the cylindrical casing of a meter divided by a partition B into two compartments C and D. The gas is supplied to the compartment C in the ordinary manner by means of a valve controlled by a float, and passes out through the chamber D after being measured by the drum E. Upon the head of the drum are fixed one or more buckets or cups F (three, for example) arranged so as to successively take up a certain quantity of gas at the moment they dip into the liquid, and to liberate the gas when they arrive at the lowest point of their course. The bubbles of gas thus liberated are collected in a hood G attached to the partition B and communicating, by means of a chamber H, with a chamber or passage I arranged upon the opposite face of the partition. An aperture J formed in the partition permits of free communication between the chambers H and I. The chamber I is prolonged at its lower part in the form of a tube K, whose extremity is received within the flared end of a tube L, which opens into a chamber M provided with a perforated bottom for the admission of water contained in the hydraulic compartment of the meter. A cap N is interposed between the wall of the chamber M and the mouth of the tube L to serve as an hydraulic resistance. The diameter of this tube should be sufficiently small to ensure that the adhesion of the liquid to the inner walls of the tube is sufficient to permit of the bubbles of gas acting as a piston.

The tube L rises at its other extremity above the normal level of the water in the compartment containing the measuring drum; and it discharges the water, which is forced, in the manner hereafter described, into an auxiliary reservoir O, which is in communication with the compartment containing the drum E, by means of one or more orifices P in the partition B. The reservoir is furnished with an overflow pipe Q.

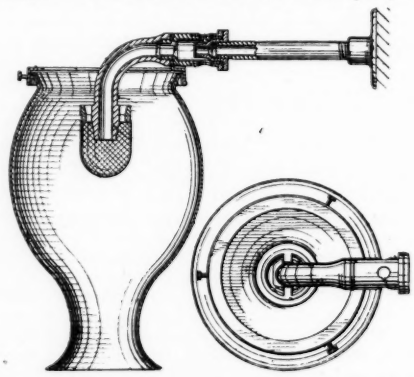
The action of the apparatus is as follows: The cups F, which are carried round by the drum E, successively take up a certain quantity of gas, which they liberate only when they arrive at the lowest point of their course. The bubbles of gas so liberated are received in the hood G, and are thence conducted, by means of the chamber H, into the chamber I, which is closed on the drum side by an hydraulic seal of a depth S, and on the side of the hydraulic compartment by a seal of a depth S^1. As the seal S^1 is less than the seal S, it will be evident that the gas will escape from the extremity of the tube K as soon as the pressure in chamber I exceeds that due to the depth S^1 of the water contained in the tube L.

The gas, on escaping from the tube K, passes up through the tube L rather than through the bottom of the chamber M, inasmuch as the cap N, in conjunction with the flared extremity of the tube L, constitutes a series of baffles which create an hydraulic resistance that is superior to the resistance opposed by the tube L. The bubbles of gas in rising through the tube act as a piston, and force before them the water contained in the tube, which water is discharged into the reservoir O and thence passes into the drum compartment.

In consequence of the action produced by the escape of the gas from the extremity of the tube K, the pressure in chamber I falls, and the water then enters through the perforations into chamber M and thence into the tube L, the upper extremity of which opens freely above the water and into the tube K. In consequence of the gas being supplied to chamber I by the cups F in a regular manner, the pressure rises little by little until it has attained the required degree for permitting the gas to again escape from the end of the tube K into the tube L and force out a fresh quantity of water, as before described. The same phenomena are thus reproduced successively in bringing about an intermittent delivery of water into the drum compartment of the meter; the water in excess passing away through the overflow pipe Q and being returned to the reserve in the hydraulic compartment.

Inverted Incandescent Gas-Burners.—Cuttell, T. L., and the Anti-Vibration Incandescent Lighting Company, Limited, of Leeds. No. 27,473; Dec. 15, 1903.

The object of this invention is to provide a burner in which the bunsen is situated in such a position that the hot gases from the luminous mantle do not come in contact with the bunsen and its adjacent pendant or bracket, by employing a short bent pipe or tube having its opposite axes arranged at about right angles, so that the upper part of it is in a horizontal line while the lower portion is depended vertically. The burner-head carrying the mantle is located (as shown) on the lower end of the vertical portion of the bent tube; while the bunsen is on the outer end of the horizontal portion of the



tube. The bunsen burner so formed may be attached to any pendant or bracket; "in all cases the arrangement being such that the bunsen is situated in a horizontal line, while the burner-head and its mantle are at a suitable distance therefrom in a vertical position."

APPLICATIONS FOR LETTERS PATENT.

23,444.—Hill, H., "Mantles." Oct. 31.
23,466.—Farkas, A., "Inverted incandescent gas-lamps." Oct. 31.
23,523.—Wolfson, J., "Anti-vibrator." Nov. 1.
23,526.—M'Callum, W., "Mantle supports." Nov. 1.
23,539.—Dyer. J. H., "Clamps for pipes." Nov. 1.
23,609.—Johnson, J. Y., "Water-meters." A communication from W. Ferris. Nov. 1.
23,610.—Wood, E., "Gas-burners." Nov. 1.
23,675.—Blau, H., "Gas making." Nov. 2.
23,680.—Rud. Rütgers Chemische Fabrik Für Teerprodukte, "Treatment of heavy tar oils for the manufacture of pitch or of a special kind of tar." Nov. 2.
23,683.—Shaw, E. J., "Inverted incandescent lamps." Nov. 2.
23,686.—Kamm, L., "Acetylene lamps and burners." Nov. 2.
23,693.—Crawford, V. M., "Gas-engines." Nov. 2.
23,775.—Durnford, C. W., "Regulating the flow of gases and fluids." Nov. 3.
23,787.—Griffin, E. F., and Cox, F. J., "Production of gas." Nov. 3.
23,810.—Tilley, F. C., "Atmospheric burners." Nov. 3.
23,862.—Laidlaw, W. K., "Lighting incandescent street gas-lamps." Nov. 4.
23,884.—Farwell, F. O., "Gas-engines." Nov. 4.
23,944.—Goldston, G., "Incandescent gas lighting." Nov. 5.
23,946.—Hanwell, H. W., "Gas-pendants." Nov. 5.
23,983.—Ray, E., "Continuous distillation." Nov. 5.
23,984.—Brunck, R., "Extraction of ammonia from distillation gases." Nov. 5.

Sales of Stocks and Shares.—At the Mart, Tokenhouse Yard, on Monday last week, Mr. Alfred Richards sold, by order of the Directors, sufficient £10 preference shares (5 per cent.) of the South-West Suburban Water Company as would produce, with the premiums, £22,266 17s. 6d. The prices realized were £11 8s. 6d. to £12 1s. per share. On the same occasion, he carried out the instructions of the Directors of the Grays Gas Company, Limited, to place 300 fully-paid £10 "B" shares, ranking for a maximum dividend of 7 per cent.; the last dividend on similar capital having been at the rate of £5 12s. per cent. per annum. The shares fetched from £10 to £10 15s. each. A parcel of £920 of "C" 10 per cent. stock of the Barnet District Gas and Water Company (last dividend 7½ per cent.) realized £150 and £151 per £100 of stock. At a recent sale at Wellingborough, Messrs. Pendered and Son disposed of 300 ordinary £10 shares in the Wellingborough Gas Company at £19 9s. and £19 12s. each.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Testing Incandescent Burners and Mantles.

SIR,—I am sorry to see, by your issue of the 8th inst., that Mr. Holgate has now less confidence in the results of the tests of incandescent burners and mantles which he published some time ago. Since he has had opportunities of investigating the matter for himself, and not being in a position to determine whether the abnormally high figures were affected by the two possible sources of error which he mentions, and has not the same quality of gas which he had at Halifax, it would be interesting to know how he obtained the results which caused him to lose confidence in them. I venture to think it would only be right to those who are interested in the testing of incandescent burners and mantles, and those who carried out for him the tests referred to, that he should state fully the method of testing he adopted, and how he proved that it was better than the one used at Halifax; also how he allowed for the difference in the quality of the gas used.

I should also like to thank Mr. Mallol for his remarks on the appendix, which I think fairly lends itself to criticism, owing to the incomplete manner in which the results are stated; but as I consider some explanation is due to him, I will try to explain them as soon as I have time to go into the matter.

Halifax, Nov. 12, 1904. JAS. F. SMITH.

SIR,—One cannot but agree with the conclusion that a standard incandescent burner and mantle for testing purposes are out of the question. Good, however, will be achieved by establishing, as far as possible, greater uniformity in the method of testing; and the suggestion made in your editorial last week should meet with ready acquiescence. There can be little doubt that the varying efficiency results published by makers and engineers have been largely due to differences in the testing means adopted, and the effect of the personal equation where colour and bunsen disc "balancing" have been concerned. I have had occasion to test some few burners and mantles with the "Flicker" photometer; and the personal factor being lessened, the readings have been much more readily obtained, have been more concordant over a series of tests, and the general results less open to doubt than was previously the case with the ordinary bar and bunsen disc. The physical effort, tiring to the eye as it is, of balancing one colour against another, or of gauging the respective intensities of the disc outline, is apt to spoil one's judgment.

If only to indicate the possibility of varying results, the following notes of incandescent burner tests may not be uninteresting. In one instance, a "C" burner and mantle of good make were under examination. With a gas consumption of 4·1 cubic feet, this burner, tested with the ordinary bar and both bunsen and star discs, yielded 98 candles as an average of four tests. On the "Flicker" photometer, only 91 candles were obtained. An older mantle on the same burner gave respectively 69 and 64 candles. In a third case, a defective Kern burner and mantle yielded 38 and 35 candles—the latter result being with the "Flicker" photometer. As indicating the difficulty of getting even the same percentage of variation, it may be mentioned that a "Bijou" inverted burner yielded, with the "Flicker" system, a fairly constant result of 14·5 candles per cubic foot, over 120 hours.

The concordant results of the various tests left little doubt as to accuracy. Tested on two different days, however, with the bunsen disc, the readings neither exactly agreed with each other nor with the 14·5 candles obtained on the "Flicker" photometer. On the other hand, there have been one or two tests of other burners in which the readings have approximately agreed. These variations can only lead one to mistrust results dependent to so great an extent upon the personal equation; and, speaking impartially, I am bound to agree with Mr. Abady that the "Flicker" system is the only one at present which permits of accurate comparison between incandescent gas-burners and the usual standards of light. It is possible that, by the more universal use of this photometer, some highly rated burners will have to be denominated at a lower figure, but no one will be the loser. I have in use a number of nominally "40 candles per foot" high-power lamps; but, truth to tell, I have never been able to get more than 27 candles as tested with the "Flicker" photometer. This fact notwithstanding, it must be admitted that, in brilliancy and effect, they are doing excellent service, and are all that imagination may have attributed to a 40-candle efficiency.

I would suggest that if makers of lamps would state efficiencies in candles per foot "as tested by the 'Flicker' system," the figures would meet with readier acceptance than the bare and unqualified statements so frequently made. Only this week, an ordinary incandescent burner was offered to me as giving 250 candles with from 6 to 7 cubic feet gas consumption. The mere claim obviously discountenanced business. The nominal and unverified rating of burners does the gas industry an injury; and this discussion may be useful in checking what appears to be a growing tendency.

Doncaster, Nov. 12, 1904. ROBERT WATSON.

Church Lighting—A Suggestion for the Exhibition.

SIR,—I am sure the engineers and managers of the gas undertakings of the United Kingdom are looking forward with unusual interest to the forthcoming International Gas Exhibition, and for me to make suggestions at this late hour will be superfluous. I trust, however, the exhibitors interested in church lighting will have some practical, and I might almost say beautiful, ideas to unfold in regard to this department of their business. I have entered many churches, especially on the south coast, during the past summer, and have been surprised at the crude ideas which have surrounded the attempt to improve the lighting with incandescent burners, but with the most ugly and glaring kinds of shade pendants that could be introduced. I felt sure that the heads of gas departments had never been consulted, or such bad taste would not have been displayed. It is a subject worth attention, and no doubt will be fully considered at Earl's Court by all the leading manufacturers of gas-fittings and accessories.

We feel greatly indebted to all the leading men interested in the Exhibition. They will doubtless see the products of their labour in the creation of an enormous increase of trade in the country generally.

Aylesbury, Nov. 12, 1904. GEORGE LANE.

Purification by Lime.

SIR,—Will you permit me, although not a member of the gas profession, to make a few remarks on this question? I have been for almost half-a-century an active director of a small gas company sending out about 25 million cubic feet per annum. We pass our gas through a large condenser, next through a Livesey washer and a Kirkham washer-scrubber, then through oxide purifiers, taking out the sulphuretted hydrogen, and lastly, through one of two lime purifiers of ample size. We are not troubled with naphthalene, our gas is of good illuminating power (over 16 candles without enrichment), our cost is low, and we have, I may say, no complaints in regard to quality. Why cannot other gas companies, if they have room enough, finish their purification with a lime box?

Nov. 12, 1904. A GAS DIRECTOR.

Valves for Purifiers—"Milbourne v. Pickering."

SIR,—The report of this opposition case, in your last issue, omits several very important points, and indicates that your statement is altogether an *ex parte* one. I was not represented by Counsel, as stated, but by Mr. George W. Johnson, of the firm of Messrs. Johnson and Wilcox, patent agents.

The arrangement for which Mr. Pickering desired protection—viz., using the valve covered by my patent No. 11,356 of 1901, *outside* instead of *inside* the purifiers—is one for which I had been advised in January, 1903, that it would be unnecessary to take out a special patent. Upon this patent referred to, I intend to rely, and prosecute any infringement of my special form of valve. Furthermore, as a plain matter of fact, capable of indisputable proof, this very arrangement (for which Mr. Pickering now claims protection) had been actually published and brought before the notice of gas engineers by my firm—Messrs. C. & W. Walker, Limited—several months before the date of Mr. Pickering's application for protection. Drawings were submitted to the British Gaslight Company, Etruria, for these outside valves and connections, at least four months before Mr. Pickering appears to have bethought himself of the arrangement. Messrs. C. & W. Walker's tender was eventually accepted, and the purifiers have now been erected at Etruria works, with *outside* valves, for a considerable time.

This prior publication effectually bars the success of Mr. Pickering's claim, even if it were a valid one. But it should be specially noted that the Comptroller of the Patent Office, after hearing both sides, stated that he expressed no opinion as to the validity of the patent granted to Mr. Pickering.

Muxton, near Newport, Salop, Nov. 9, 1904. R. J. MILBOURNE.

In order to prevent, if possible, any further discussion of this "patent grievance" in the "JOURNAL," the letter from Mr. Milbourne was submitted to Mr. Pickering, who replies as follows:—

SIR,—Mr. Milbourne's letter is distinctly entertaining. He complains that your report is *ex parte*, and then immediately proceeds to supply "several important points," not one of which is relevant to the matter at issue in the proceedings, and not one of which was proved, or was attempted to be proved, in evidence on the opposition in question. The questions raised in Mr. Milbourne's letter are not capable of any useful public discussion; but the "points" he mentions involve substantial inaccuracies which you will perhaps permit me briefly to expose.

Mr. Milbourne states that I applied for protection in respect to a valve covered in his patent No. 11,356 of 1901. This has not a shadow of foundation in fact. His patent relates exclusively to an inside combination of valves and connections, which involves inlet and outlet valves of the double-faced disc type. It has for its particular object to dispense with external valves; and its claims are exclusively confined to the internal disposition. Now my patent relates exclusively to an external arrangement of valves and connections; but I happen to use the well-known double-faced disc valves, for which I am certainly not indebted to Mr. Milbourne, and he was not so ill-advised as to claim such valves in his patent.

Again, the statement made by him that, "after hearing both sides," the Comptroller expressed no opinion as to the validity of the patent, raises a false suggestion; for throughout the hearing nothing whatever was stated by my representative in regard to the validity of my claims. This is a question that was not in issue, and that was not, and could not be, contested before the Comptroller. There is no reason to believe that my claims are otherwise than perfectly valid.

As to the allegation of prior user, I am unable to enter into a newspaper discussion of it. I have simply to say that any infringement of my patent on the external arrangement of valves that I have patented will be rigorously prosecuted.

In conclusion, I may remark that the only point upon which the report gains in accuracy from Mr. Milbourne's letter is as to the name of his representative. But as the particular Counsel mentioned was briefed on his behalf, and doubtless was consulted as to the presentation of the case to the Comptroller, this is hardly of importance.

Exeter, Nov. 12, 1904. W. S. PICKERING.

LEGAL INTELLIGENCE.

GREENWICH POLICE COURT.—Tuesday, Nov. 8.

(*Before Mr.* ERNEST BAGGALLAY.)

Lewisham Borough Council v. South Suburban Gas Company. Illuminating Power and Sulphur Compounds.

To-day, the South Suburban Gas Company appeared in answer to two summonses issued at the instance of the Lewisham Borough Council for having, on Aug. 30 last, supplied gas of less purity and illuminating power than prescribed by their Acts of Parliament. This is the first result of the new policy of the Directors in connection with these matters, as set out in the circular addressed to the consumers in July last (see "JOURNAL" for July 12, p. 94).

Mr. MUIR MACKENZIE represented the Lewisham Borough Council; Mr. HORACE AVORY, K.C., with him Mr. T. T. BLYTH (instructed by Mr. C. F. T. Blyth, of Messrs. Blyth, Dutton, Hartley, and Blyth), appeared for the Company.

Mr. MACKENZIE said there were two summonses against the South Suburban Gas Company—the first alleging that, upon Aug. 30, the gas supplied was of less purity than it ought to have been, and the second that the gas supplied on the same day was deficient in illuminating power. In point of fact, the gas as tested was found to contain 34·51 grains of sulphur per 100 cubic feet, which was an excess above the statutory maximum of 14·51 grains; and, whereas the statute prescribed an illuminating power of 15 candles, it was found, on the date named, to be only 14·18 candles. Counsel called attention to the provisions of the various Acts bearing upon the matter. The Company was originally the Crystal Palace District Gas Company; and under that Company's Act, by section 40, the illuminating power was to be 12 candles. Then he recited the various sections of the Gas-Works Clauses Act—sections 28, 29, 33, and 36—providing for the testing-place, the appointment of a gas examiner, the reporting of the results of the tests, and for a penalty in case of default. The provisions were varied by the Crystal Palace Gas Act of 1873; section 17 prescribing that the illuminating power of the gas should be 14 candles, instead of 12 candles. It was also provided that the gas should not contain more than 20 grains of sulphur per 100 cubic feet. The provision as to illuminating power was again altered by the Company's Act of 1893; section 28 providing that the provisions of the Act of 1873 with respect to illuminating power should be varied by the number of candles being 15, instead of 14. Having read the several provisions referred to, he repeated the facts, to the effect that Mr. Howard, the Gas Examiner, tested the gas on Aug. 30, in the manner prescribed by the statutes, as incorporated in the notification of the Gas Referees. He found that the gas contained 34·51 grains of sulphur per 100 cubic feet, which was 14·51 grains above the maximum. He then proceeded to test the illuminating power, and found it to be 14·46 candles, instead of 15 candles. Then it was suggested to Mr. Howard that he should make another test; and he found, on doing so, it was 14·18 candles.

Mr. *Alfred Howard*, the Gas Examiner, was examined with the view of showing that, in every respect, he complied with the requirements of the Acts in making the tests, and that they were carried out in the presence of Mr. John Whimster, Assistant to the Company's Engineer (Mr. S. Y. Shoubridge).

Mr. AVORY (interposing) said he was not in a position to dispute the facts as to the testing or the results.

Witness (proceeding) stated that he found, as the result of the sulphur test, 34·51 grains per 100 cubic feet, and as the result of the illuminating power test, 14·46 candles. Then Mr. Whimster asked him to make a further test. He replied that having taken the test, he had ceased to be the Gas Examiner for the day. However, he was again asked to make a further test; and the result was the 14·18 candles.

Mr. AVORY said he was not in a position to dispute the fact that, on the date in question, the illuminating power was below 15 candles, and that there was an excess of sulphur in the gas. The question was therefore reduced entirely to one of whether or not any penalty, or (if any) only a nominal one, should be imposed in this case. He was under peculiar circumstances. First of all, his Worship would find that, under clause *c* of section 28 of the Act, 1893, no forfeiture was to be incurred in any question of illuminating power where the defect was occasioned by unavoidable cause or accident, and in the case of an excess of sulphur unless the excess should amount to 2 grains on six consecutive days, or 10 grains on any one day. In other words, there was to be no forfeiture if the sulphur amounted to 30 grains in 100 cubic feet of gas in one day, because, by the Act of 1873, section 17, the quantity of sulphur permitted was 20 grains in 100 cubic feet of gas. Then, by section 28 of the Act of 1893, no forfeiture was to be incurred where the excess was only 10 grains on one day. Consequently, this allowed the Company in one day 30 grains of sulphur per 100 cubic feet. But, as he had said, he was not in a position to dispute that there was on this day 34·51 grains. Therefore, there was an excess of 4½ grains of sulphur, and a deficiency of ¼ or ¾ candle in the illuminating power. But the circumstances under which this had arisen were altogether exceptional, and, having regard to the fact that, by the section of the Gas-Works Clauses Act to which his friend had called attention, the forfeiture, if any, went to the prosecuting Council, he thought his Worship would be of opinion that it ought to be nothing, or the smallest coin that was known to the Law. As his Worship had heard, the illuminating power was raised in the case of this Company in 1893; having previously been 12 and 14 candles. Since that year, as his Worship was aware, extraordinary changes had taken place in the consumption of gas for the purposes to which it was applied. First of all, it was now, as a matter of fact, more extensively used for heating than illumination, and it was now more largely used in incandescent burners than in the old-style flat-flame burners. On both these grounds, the illuminating power of gas had become a question of secondary importance to the consumer, because, burned in an incandescent burner, 12 or 13 candle gas answered the same purpose as formerly; and for heating purposes, 12 to 14 candle power answered admirably. But a further change had taken place since 1893; and it was of importance in this case. At that time, the increased illuminating power was given to the gas by the introduction into the manufacture of cannel coal; the ordinary coal not being sufficient to produce such an illuminating power as 15 candles, or anything like it. In later years, however, cannel coal had so far diminished as to make its use almost prohibitive in gas-works, with the result that those companies who were under, or had been under, an obligation to supply gas of such high illuminating power as 15 candles, had been obliged to resort to other methods of increasing the illuminating power; and it had chiefly been done by the introduction of oil, in various ways, into the manufacture. In the case of this Company, the enrichment by oil had been achieved by the manufacture of what was called carburetted water gas; and it was only by the use of this carburetted water gas that the Company had been able to keep up the illuminating power to 15 candles. Now the materials which had of necessity been employed for this purpose had unfortunately caused serious complaint of nuisance in the neighbourhood; culminating in proceedings being taken by the Lewisham Borough Council last year against the Company for polluting, or alleging that they were causing a nuisance to, a stream known as the Ravensbourne. There was an action in the High Court for heavy penalties, resulting in judgment being given against the Company—a point of law remaining open for argument. Upon the facts, it was decided that the nuisance was caused by the gas-works, due entirely to the process of manufacturing carburetted water gas. The Company therefore found themselves in this position, that they were quite unable—no gas company at the present day were able—to supply the necessary illuminating power by the use of cannel, the price of which was prohibitive. They said they could only do it by manufacturing carburetted water gas, and they could not manufacture this without rendering themselves liable to proceedings for nuisance arising from smell and from the pollution of the stream. The Company were, in fact—to use a familiar phrase—"between the devil and the deep sea." Their own Act of Parliament which prescribed 15 candles represented the devil, and the Ravensbourne the deep sea. Under the circumstances, the Company had anticipated what would happen by going to Parliament in 1903 with a Bill to reduce the illuminating power to 13 candles. The Bill passed through Committee in the House of Commons, who sanctioned the reduction to 13 candles. When it came before the Committee of the Lords, it was strongly opposed, at the instance of the Lewisham Borough Council and other persons; and as a result of the opposition, the Bill was unsuccessful before the Lord's Committee. Last session the Company again introduced a Bill into Parliament for the purpose of getting the reduction. They were met by a statement, on behalf of the Board of Trade, that a Departmental Committee were considering various questions such as the illuminating power and impurities in gas; and so the House refused to proceed further with the Bill until the Committee of the Board of Trade had reported on these questions. The Company were therefore again shelved. In the meantime, to show his Worship how it had been publicly recognized that, at the present day, a high illuminating power was not desirable in the interests of the consumer, and was unjust to the Gas Company, the learned Counsel pointed out that the South Metropolitan Company, who supplied a district very similar to the South Suburban Company's, in 1900 obtained from Parliament a reduction of their illuminating power from 16 to 14 candles. Now, the South Metropolitan Company supplied one-half of Lewisham, and the South Suburban Company the other half. So that the Lewisham Borough Council, who were getting from the South Metropolitan Company gas of 14-candle power, were complaining that they were not getting 15-candle power from the South Suburban Company. In 1902, again, the Commercial Gas Company obtained from Parliament a reduction to 14-candle power.

Mr. BAGGALLAY: You had an Act passed this year?

Mr. AVORY: We did, Sir. But all the clauses relating to illuminating power and purity were struck out, in consequence of the Committee of the Board of Trade, who were then sitting. The Bill, without these clauses, was then passed.

Mr. BAGGALLAY: Were the clauses taken out because you supplied a better class of people? Perhaps that had something to do with it.

Mr. AVORY said no such question as that was raised. The Company withdrew tho clauses practically at the dictation of Parliament because of the Board of Trade Committee.

Mr. BAGGALLAY: Your illuminating power is still 15 candles so far as I am concerned.

Mr. AVORY remarked that he thought his Worship would see that this was a case for a nominal penalty. There must be a penalty of some kind, but only a nominal one, because all the provisions to which he had been referring were in the interest of the consumers. No one else was affected by them.

Mr. BAGGALLAY: One consumer does not mind because he only burns the gas for cooking; another man who only uses it for light does complain perhaps.

Mr. AVORY: There is no consumer complaining here at all.

Mr. BAGGALLAY: The Council represent the consumers.

Mr. AVORY: They pretend to. Continuing, he said that in and since 1902, when the Commercial Company obtained a reduction, several Suburban—the Wandsworth and Putney and West Ham Companies for instance—and several Provincial Companies were also allowed a reduction to 14-candle power. What he wanted to say was that Parliament had recognized now that 14-candle power gas was sufficient in the interests of the consumer. It was a mere accident, resulting from the fact that the Board of Trade Committee were sitting, that the South Suburban Gas Company did not obtain a reduction last session. This being the position of things, the Directors of the Company had had to consider what they would do—either they must go on and create the nuisance which arose not only from the pollution of the stream, but also from the smell (of which serious complaint had been made in the neighbourhood), or they must cease to manufacture carburetted water gas, and then it would be impossible to keep up the

standard to 15 candles. They therefore resolved upon steps which were set out in a circular sent round to all the consumers, as well as to the Lewisham Borough Council, and all the members. In the circular, the whole history of the matter was stated. In 1901-2, there was complaint of nuisance; but there had never been—at any rate speaking for the past eight or ten years at all events—a complaint of any deficiency of either illuminating power or of an excess of sulphur. The matter before the Court in 1901-2 was a complaint of a nuisance arising from the use of lime; and the Magistrate refused to convict, because it was proved that the use of lime was necessary, in order to enable the Company to comply with their Act of Parliament. The learned Counsel—having read several extracts from the Directors' circular [see "JOURNAL" for July 12, p. 95], and laid stress on the result of the Board of Trade inquiry in respect of sulphur compounds—said it was very material to observe that of all the local authorities to whom this appeal was made, the Lewisham Borough Council were the only one who felt themselves bound to insist on the fulfilment of the letter of the law, because the other local authorities who were supplied with gas, and were in the area of supply, also received copies of the circular. There were six of these authorities altogether—Lambeth, Camberwell, Croydon, Lewisham, Beckenham, and Penge.

Mr. MACKENZIE objected to Mr. Avory going into these matters, as they were ones upon which he might wish to call evidence.

Mr. BAGGALLAY pointed out that Mr. Avory was only addressing him in mitigation of punishment. It was very difficult to know where to stop arguments in such a case.

Mr. MACKENZIE: He has stated a great many facts upon which another complexion might be placed.

Mr. AVORY: This fact cannot be disputed, that the Lewisham Borough Council were the only one authority who had made any complaint at all.

Mr. BAGGALLAY: That does not say what will happen.

Mr. AVORY replied that the circular had been out since July 1. The Company were obliged to break the law in one respect or the other—either they must occasion a nuisance, and have serious complaints in the neighbourhood of their works, or they must use cannel coal, which this could only be done by increasing the price of gas by perhaps 4d. per 1000 cubic feet. Under these circumstances, he said the conduct of the Directors had been above-board. They had found themselves in this predicament; and they had chosen what they believed to be the lesser of two evils. He thought it would be more important to the Local Authority that they should get rid of a nuisance in their district than that they should stand out for this ½-candle in illuminating power, which was practically of no importance to anybody in the district. Having regard also to the efforts of the Company to substitute better burners where flat-flame ones were used, and also to supply incandescent burners at cost price, whichever was chosen by the consumers, he (Mr. Avory) suggested that a nominal penalty would meet the justice of the case, until the Company were able to, and no doubt would, get legislative sanction to the reduction of illuminating power which had already been obtained by companies supplying similar districts to their own.

Mr. BAGGALLAY said that, while there was a good deal to be said in mitigation, that did not alter the fact that these things had not been met. It was his duty to inflict a penalty. There would be a fine of 40s. on each summons.

Mr. MACKENZIE: As regards costs, Sir?

Mr. BAGGALLAY: I do not think it is very important.

After a little conversation, £2 4s. costs were allowed on the first summons, and 2s. on the second one.

The Gaslight and Coke Company Fined.

At the Marylebone Police Court last Friday, the Gaslight and Coke Company were summoned by the London County Council for supplying gas at the testing-place, No. 66, George Street, Hampstead Road, of less illuminating power than it should be under their Act. Mr. W. E. Helman-Pidsley appeared in support of the summons, and said the sample of gas taken was found to be of the illuminating power of 15·35 instead of 16 candles. A plea of "Guilty" having been recorded, Mr. Curtis Bennett ordered the Company to forfeit a sum of 40s., with £2 2s. costs.

The "Coninco" Trade Mark.

In the Chancery Division of the High Court of Justice last Tuesday, Mr. Justice Kekewich had before him an appeal from the refusal of the Comptroller of Patents to register as a trade mark the word "Coninco" in respect of mantles for incandescent gas lighting. The applicant, Mr. John Altman, had purchased the business previously carried on by Mr. George Boehm as the Coninco Mantle Company; and upon applying for registration, the Comptroller, noticing that the document submitted bore the words "Coninco Mantle, Registered Trade Mark," declined to proceed with the registration, as he considered the applicant had no right to use the words "registered trade mark," there having been no prior registration. Applicant stated that he knew nothing of the earlier proceedings; but, on the purchase of the goodwill, for which he paid a large sum, he understood that application had been made for a trade mark. Upon search being made, it was found that there had been registration at Stationers' Hall instead of at the Trade Marks Office; the applicants being the Continental Gaslight Company, and the mantle being registered as a book. Mr. A. J. Walter appeared in support of the motion; and Mr. R. J. Parker represented the Comptroller, who left the matter entirely to the Court. His Lordship thought there had been a *bonâ fide* mistake, and directed the Comptroller to proceed with the registration in the usual way.

Messrs. Joseph Taylor and Co., of Bolton, have received an order from the Clonmel Corporation for a solid-plate lead saturator (specified by their Consulting Engineer, Mr. Isaac Carr), for the new sulphate plant about to be erected.

MISCELLANEOUS NEWS.

THE MUNICIPAL TRADING QUESTION IN EDINBURGH.

Mr. Herring's Replies to the Traders' Statements.

In the "JOURNAL" for the 18th ult. (p. 190) a very full report was given of the proceedings at a meeting of the Edinburgh and Leith Gas Commissioners, when deputations of traders were received upon the question of the Commissioners trading in gas stoves and fittings. It was then stated that Mr. Herring was asked to reply to some of the statements which had been made. Mr. Herring's answer has now been lodged, and the Commissioners have had it printed in a form which is most convenient for reference; the replies being given on the opposite pages of the folios upon which the statements appear. But the task of conveying them to our readers is somewhat difficult, without continual reference to the statement to which each reply is made. Probably to those who wish to go into the matter, a reference to the report given on the 18th ult., will assist in following the subject. The replies are headed "Memorandum of Facts by Mr. W. R. Herring for the Information of the Committee, in reply to the Statements made at the Conferences between the Edinburgh and Leith Corporations Gas Commissioners and Deputations from the Edinburgh South Side Merchants' Association and the Edinburgh Ironmongers' and Plumbers' Association." The replies are to the following effect.

The policy of fitting up stoves and other gas fittings was inaugurated on April 26, 1897:

1.—The following towns and cities, among others, have found it necessary to embark in this business in order to lead the trade and satisfy their consumers: Glasgow, London, Sheffield, Birmingham, Nottingham, Bradford, Leicester, Liverpool (formed Company), Stockport, York, Leeds, Dublin, Manchester, and Newcastle.

2.—Parliament conferred such powers in clause 71 of the Commissioners' Act of 1888. This clause is common to all gas undertakings.

3.—Our detailed records of the cost of work done can be produced and compared with the cost of work done by individual traders.

4.—Judging by the number of people—1739—who have already visited our new show-rooms, it is quite evident the consumers have every confidence in the Gas Commissioners' ability to meet their wants.

5.—No direct charge is made for the labour and pipes in connection with gas-cookers; but the Gas Commissioners receive an annual income of 10 per cent. per annum for the work done in connection with the supply of the cooker, and the material and labour involved in its delivery and fitting up.

6.—Parliament having established a gas supply as a municipal trading concern, also conferred such powers as were thought necessary to render such trading profitable to the community.

7.—There is no loss on this department. Since 1890, the Commissioners have purchased £33,370 worth of stoves, of which they have sold £7226 worth; leaving a net balance of £26,144. The annual rental received for the hire of these stoves amounted last year to £3296. This represents a return of 12½ per cent. on the capital outlay.

8.—Gas used in stoves and cookers represents an increased consumption over and above that required for lighting, and may be said to give employment to the plant and distributory system when it would otherwise be idle. Under these circumstances, the cost of production is 1s. 3·23d. per 1000 cubic feet less, so that the gas consumer who has no stoves shares in this economy at the expense of the parties who now use gas-stoves.

9.—We do not cut prices—on the contrary, we make a handsome profit on the fittings we sell, amounting, in some cases, to 100 per cent.; whereas the following cities sell goods at the discounts enumerated below: Sheffield adds 15 per cent. to net cost. Glasgow sells at 15 per cent. off trade list. Bradford charges a price sufficient to cover expenses in dealing with goods. London sells at 25 per cent. off trade list. York sells at 25 per cent. profit. Leeds sells at 10 per cent. off trade list. Dublin sells at 20 per cent. off trade list. Newcastle sells at 12½ to 33⅓ per cent. off trade list. Manchester sells at 10 to 20 per cent. off trade list.

Apart from screwing on burners and similar work to existing fittings, we do not fit up gas appliances free of charge. As we make 100 per cent. profit on such goods as burners, pendants, globes, brackets, &c., we can well afford to do this and still make a very handsome profit. In two instances only, for the sake of demonstration, incandescent burners were fitted in shops selected for prominent position—viz. (1) Mr. Swan, 6, Nicholson Street, fitted and maintained for seven months in 1903; discontinued at Mr. Swan's request. (2) Mr. R. Lawson, 2, Hope Street, four burners, fitted on April 7, 1903; only one mantle renewed up to present.

There are at present twenty manufacturers of gas-stoves throughout the country. The fact of the Commissioners selling or hiring more gas appliances cannot possibly deprive skilled tradesmen of work, but, on the contrary, find more work for such men.

The Gas Commissioners' staff of employees have to attend to the wants and complaints of 86,089 consumers, consisting of the following varieties of work: The fitting in of new service-pipes, meters, public lamps, stair lights, turning on gas to new consumers, and discontinuing it to others, the transfer of consumers' accounts from one residence to another, attention to escapes, deficiencies and complaints of bad gas, and a host of other *et ceteras*. Any discontinuance of the trading in gas stoves and appliances would in no way reduce the cost of working this department, but, on the contrary, is calculated to add to it, as it will deprive us of sundry work, which comes at a time of the year when we are in the best position to do this work without any additional cost to the administration, apart from wages. The work of this department is divided into fairly uniform periods. The fixing of cooking stoves comes at the time of the year when we would otherwise be obliged to discharge our regular hands. The attention to lighting and burners, &c., comes at a time when the cooking business is easing off and the lighting season commencing. The fixing of meters and the supplying of new properties comes in the early spring of the year; so

that, by this means, regular and better employment is found for the operators, and the work can be sandwiched in much more easily than if we were not to conduct our business in the way we do. If it were not for the manner in which the gas-stove business has been worked, the consumers to-day would have to pay at least 1d., if not 2d., per 1000 cubic feet more for their gas all round. A policy that is pursued by many English and Scottish corporations cannot possibly be so wrong as the memorialists appear to think.

This exhausts the points raised in the memorial of the South Side Merchants' Association; and Mr. Herring proceeds to reply to the statements made by members of the deputations. The cost of materials and labour in fitting up gas-stoves is, he says, covered by the 10 per cent. rental for the hire of same. The clause in the Commissioners' Act of 1888 is in every way similar to the Parliamentary Model Bill Clause common to all Gas Acts. Similar powers were granted during the last session of Parliament to the following Corporations; the information being obtained from our Parliamentary Agent, who has supplied me with the following: "We have inquired into the cases referred to, and have got the following information: (1) Cheltenham Improvement, 1903—Notice given in 'Gazette' containing intention to apply for such a Bill, but not deposited in Parliament at all. (2) Leeds Corporation Consolidation, 1904—Bill contains this clause, which was passed by the Police and Sanitary Committees of the House of Commons, and will be proceeded with next session in the Lords. (3) Brighton Corporation Act, 1901, section 79—The clause was opposed by the Ironmongers' Association of Brighton; evidence led, and parties heard; clause was modified by striking out words empowering Corporation to wire. With this trifling exception, the power was granted. (4) Tunbridge Wells—I cannot find this case. The following cases were passed in 1900 with the clause—namely: Salford Corporation, Coventry Corporation, Halifax Corporation, Morley Corporation, Walsall Corporation, West Bromwich Corporation, Devonport Corporation, Kingston Company, and Southport Corporation. Mr. Morrison's instance of the London County Council Bill of last year had reference to the London County Council seeking powers in the matter of electrical wiring and fitting, not for itself, but for the Metropolitan Borough Councils, which it did not obtain; but it is again renewing its application at the coming session of Parliament. The following Corporations did, however, obtain these powers in 1903: Dover, Erith, Sheffield, Nantwich, Pontypridd, Aston Manor, Leigh, Sutton Coldfield, Willesden, Exeter, Beckenham, and Wood Green."

As to the field for the utilization of gas being still undeveloped, it is my opinion, founded upon long experience, that the cause of this is the high price charged for subsidiary appliances for which gas can be used in the household. The Commissioners can buy gas-fittings, globes, and similar appliances and make 100 per cent. profit on their sale at list prices. Gas cooking-stoves, fires, &c., are bought at such a price as to return 50 per cent. profit on their sale. During the year ending March 15, 1904, 1214 cookers were fitted to new consumers, costing £365 for material, or an average of 6s. each, and £328 for labour, or an average of 5s. 5d. each, together showing an average of 11s. 5d. The petitioners say they would have no difficulty in showing this work is being done at considerably more expense. If it were done by the trade, there is no doubt it would be much more costly. We could not have better evidence of the efficiency of the Commissioners' work than this admission on their part. The total trading account by the Commissioners, including gas-cooking appliances, has amounted to £11,128, or an average of £800 per annum. The trading account for the year ending 1904 is £1568. If we divide this among the 350 traders mentioned by Mr. Morrison, it averages £4 10s. per annum per trader. Assuming that 100 per cent. profit is made on these transactions by the trader, his entire loss is £2 5s.

The remark referred to in the paragraph in my former Memorandum, "I have been making particular inquiries" (see "JOURNAL" for July 12 last, page 129), is absolutely correct, as will be seen by reference to the statement following, which was handed in by Mr. Morrison. The black type is Mr. Morrison's statement. The red type are the corrections I thought it necessary to make, based on the information obtained direct from the management of the various concerns. My references to discounts are perfectly correct.

[A table is given, containing eight questions addressed by Mr. Morrison to various towns, with the replies to them, and the corrections by Mr. Herring.]

Out of 41 ironmongers and plumbers who have signed the petition to the Commissioners, 25 have their premises lighted by gas, and 16 by electricity. A careful inspection was made of the premises of each of the petitioners, about the beginning of June last; 12 of them had no indication whatever that they traded in any of the above goods; 16 of the number exhibited gas fires and cooking appliances. Presumably, the 50 per cent. profit made on the sale of these goods has not influenced the traders in exhibiting them. The Commissioners are not by law allowed to sell at a differential rate for this purpose.

Mr. Morrison having handed in a statement as to "Instances of work done by the Gas Commissioners free," Mr. Herring replies to them to the following effect: (1) Newington U. F. Church.—The whole interior fitted up with incandescent burners, including two Lucas lamps, for which they were charged, and paid, on Nov. 25, 1903; a substantial profit accruing to the Commissioners. (2) Church in Dalry.—Instructions to charge for the fittings already up, and supply some additional fittings, all of which is being done at a substantial profit. (3) St. David's U. F. Church.—Four incandescent burners put on to show how church could be lighted, but taken off in April, 1904, and no charge made. (4) Wrote to Mr. Morrison requesting particulars of date and address, but have been unable to elicit the information. (5) Trader refused discount on purchase of two gas-stoves for about £4.—No reply. (6) St. Giles's Cathedral.—Whole Cathedral fitted up with No. 3 Bray burners, and thus retained as a gas consumer, instead of our losing a good customer. (7) Have had no transactions with anyone reporting himself as a customer of Mr. Blackie's, nor did we sell eight gas-fires to any individual during the present year. (8) Case not authenticated. (9) The whole account paid on Jan. 2, 1902; a substantial profit accruing to the Commissioners. (10) Account paid on Nov. 17, 1903; all requirements for upkeep were paid for, a substantial profit accruing to the Commissioners. (11) Mr. Swan's shop.—Fitted up and maintained for seven months in 1903, to display incandescent lighting as applied to window illumination. (12) Several shops kept up by Commissioners with mantles.—Statement is correct. (13) Craigleith Poorhouse.—Fitted up with twenty-six incandescent burners in 1903, the charge for which was duly rendered and paid for. All renewals have since been rendered for and paid; a substantial profit accruing to the Commissioners. (14) Burgh Assessor's Office.—Sixteen incandescent burners, all duly rendered for and paid. All renewals have since been rendered for and paid; a substantial profit accruing to the Commissioners.

The book valuation of stoves only represents the stoves that have been recently purchased; whereas we have many stoves out in first-class condition that were purchased fourteen and fifteen years ago. Mr. Gilchrist's statements as to the loss on this department are fundamentally wrong. He has arrived at his figures partly by deduction and partly from those given in my statement.

The following is a list of traders who have purchased goods and received 20 per cent. discount from the Commissioners since the beginning of the year 1901. It will be seen that no less than eight of these have signed the petition, notwithstanding the fact that Mr. Gilchrist says: "Not a trader can be found who received any better terms in this respect than the public."

[Then follow the names and addresses of 33 traders in Edinburgh and Leith.]

The replies I have already furnished to the statement of the petitioners will, I think, be sufficient to satisfy the Commissioners that what I have stated before are established facts, and cannot be set aside by mere assertions and general statements.

Dealing with the statement that Corporation fittings had been left behind in a house, Mr. Herring says:

Notwithstanding Mr. Gilchrist's promise to give the name of the customer and the house in which the goods were fitted, he has failed to fulfil his promise; and we are unable to trace anything with regard to the incident. Some fittings have been delivered to me; but they are such as could be purchased by anybody. Our estimate of their cost is 1s. 5d. Mr. Gilchrist, however, gives further illustrations with reference to piping being left behind, and refers us to the following cases. [Three instances given.] I have had these three cases specially investigated; and I find that they are all of an exactly similar character. The piping referred to is the service-pipe from the meter to stove, temporarily removed, and is an exact parallel with the piping being left in a house temporarily lighted by oil or electricity, and does not by any stretch of imagination bear the slightest resemblance to the instance referred to by Mr. Gilchrist, as to the quantities of piping and other materials being left behind to become the property of anyone who may choose to lay hands on it.

Mr. Gilchrist's concluding statements are general statements unsupported by any facts. As to the statement of Mr. Cairns, that he had been refused discount, it is said: I find that Mr. Cairns did not make himself known to the show-room attendant. Consequently the account was charged as to an ordinary customer. The collector who collects the account is responsible for the sum named on the face thereof. The special burners on sale at the district show-rooms, being sold at 1d. each, return a small profit on the transaction; 1596 have been sold since they were first put into the show-rooms a few weeks ago.

The Sub-Committee who were appointed to consider the whole matter as to the Stove Department, met on Monday, the 7th inst.; and having had before them the notes of the conference, with the further report by the Engineer, resolved to recommend that the Commissioners should continue the show-rooms and offices for the sale of gas-cookers, gas-fires, and other gas appliances, as being necessary for the carrying on of the Commissioners' business. They further resolved to recommend that a circular be sent out to all the tradesmen connected with the supplying of gas apparatus, explaining the terms on which they could be supplied with all goods sold by the Commissioners; and they also resolved to ask authority from the Commissioners to adjust the terms. Bailie Douglas dissented.

RIPON CORPORATION GAS SUPPLY.

The Past Half-Year's Working.

The Gas Engineer and Manager of the Ripon Corporation (Mr. W. T. Lancaster) has lately presented his report for the six months ending the 30th of September. He regards it as fairly satisfactory, seeing that everything had to be paid for out of revenue. The total quantity of gas made was 12,475,300 cubic feet, compared with 12,195,100 cubic feet in the corresponding period of 1903; being an increase of 280,200 cubic feet, or 2·29 per cent. The gas sent out was 12,456,198 cubic feet, whereas in the summer six months of 1903 it was 12,265,267 cubic feet; being an increase of 190,931 cubic feet, or 1·55 per cent. The bulk of coal carbonized for the two periods was 1199 tons 3 cwt., yielding an average of 10,403 cubic feet per ton in 1904, and 1154 tons 3 cwt., giving an average of 10,566 cubic feet per ton in 1903—being a decreased yield of 163 cubic feet. The amount of gas sold or accounted for was 11,702,916 cubic feet, divided as follows: Slot meters, 1,656,070 cubic feet; ordinary meters and sundries, 9,302,726 cubic feet; public buildings, &c., 83,700 cubic feet; gas-works (including house), 77,600 cubic feet; street lighting, 582,820 cubic feet. This left 753,282 cubic feet unaccounted for, or equal to 6·04 per cent. of the gas sent out, which meant that there had been sold 709,587 cubic feet, or 6·06 per cent., more gas than in the corresponding period of last year, though only 190,931 cubic feet more were sent out—showing a further reduction of 4·33 per cent. in the leakage. In 1902, the unaccounted-for gas was equal to 12 per cent.; and in 1903 to 10·37 per cent. There was a saving of £196 in wages in the period reported upon, compared with the corresponding six months of 1903. The total cost of gas into the holders, exclusive of the value of the residuals produced and the materials used, was 7·12d. per 1000 cubic feet, against 8·87d. before. Mr. Lancaster closed his report by expressing the hope that he would be able to effect still further improvement by the end of the financial year.

WIDNES GAS-WORKS EXTENSIONS.

At the Meeting of the Widnes Town Council last Wednesday, two schemes, involving an expenditure of rather more than £50,000, were brought forward by the Gas Committee for the purpose of extending the gas-works and other improvements. Alderman Timmis, the Chairman of the Committee, proposed the adoption of the schemes, which he said were first brought before the Council in October last year. The total consumption of gas had very nearly approached the full manufacturing capacity of the works, and the consequence was that they had to provide more room for plant to meet the increased demand. The first part of the scheme dealt with the extension of the retort-house, and it was estimated that they would require 280 retorts during the winter; leaving only 28 to spare. It was proposed that the present house should be extended so as to allow room for 98 additional retorts. In 1883-4, the maximum make on one day was 306,000 cubic feet. In 1893-4, it was 701,000 cubic feet, and the consumption was 713,000 cubic feet. The present maximum make per day was 1,181,000 cubic feet, and the greatest consumption 1,278,000 cubic feet. Thus they had practically no surplus over the present demand; and if anything happened at the works, the town might be in darkness for a considerable time. The £5000 required for the retort-house extension was provided by their present borrowing powers. In the second part of the scheme, they provided for the future as far as they could judge; and it would, it was estimated, cost £42,600, exclusive of the price of the land required. They proposed to purchase land belonging to the United Alkali Company, and to erect a gasholder and new gas-producing plant thereon, which would increase the total capacity of the works to 3½ million cubic feet per day. Alderman Gossage seconded the proposition. Alderman Timmis, in answer to a question, said the total capital expenditure of the works was £105,040, or £382 per million cubic feet of gas sold; but the existing capital, after deducting the sum redeemed by the sinking fund, amounted to £72,423, or £263 per million cubic feet, which was probably less than that of any other municipal gas undertaking in the kingdom. Mr. Boyle understood that there was £6000 or £7000 profit on the gas, and he asked why this amount should not be applied in carrying out the schemes instead of borrowing. Mr. Owens, the Chairman of the Finance Committee, said the total profit on the gas undertaking was £21,000; but it existed in stocks and accounts, and at present was not convertible into its equivalent. After some further discussion, the schemes were adopted.

Another Rivington Arbitration.—An arbitration was held last week at Liverpool to determine the price to be paid by the Corporation for the house and goods of a Mr. Birtwistle, situated on the Rivington watershed. The estate is held on a lease for 999 years, granted in 1870. Mr. T. T. Wainwright, of Liverpool, and Mr. Henry Ross, of Accrington, gave evidence as to the value of Mr. Birtwistle's interest; their net valuations being £2294 and £2134. For the Corporation, Mr. Henry Hartley valued the interest at £326, and Mr. Benjamin Sykes, of Preston, at £353. The Umpire was Mr. William Thomson, and the Arbitrators Mr. Edwin Hamer and Mr. E. Lovell Clare. The award was reserved.

SOUTHPORT CORPORATION GAS UNDERTAKING.

Additional Borrowing Powers for the Supply of Stoves and Fittings.

At the Town Hall, Southport, last Tuesday, Mr. E. P. BURD, one of the Inspectors of the Local Government Board, conducted an inquiry into an application of the Southport Town Council for sanction to borrow £15,000 for the purpose of providing gas cooking-ovens, stoves, meters, burners, fittings, &c., required during the ensuing four years. Among those present were Mr. E. Trounson (the Chairman of the Gas Committee), Mr. J. Bond (the Gas Engineer), Mr. J. E. Jarratt (the Town Clerk), and Mr. G. Lloyd (the Borough Treasurer). There was no opposition.

The TOWN CLERK said the application was for further financial assistance to enable the Corporation to exercise the powers conferred upon them by the Board in the Provisional Order of 1895, which authorized them to sell or let on hire gas cooking-stoves, burners, and other appliances used for either lighting or cooking purposes. Borrowing powers were then granted to the extent of £10,000; and by the Orders of 1899 and 1903, this sum had been extended to £16,500. At the time of the last inquiry, in February last year, it was anticipated that the sum for which the Corporation then applied—viz., £1500—would carry them over several years. But the whole of the amount sanctioned had been raised; and, owing to the fact that during the earlier part of the present year the manufacturers who made the stoves used in Southport held gas exhibitions in the town, and canvassed energetically for orders, and also as the result of the use of penny-in-the-slot meters, so many orders had been given that the Corporation found it necessary to apply much earlier than they expected for further financial powers. The application now was for £15,000; and the Corporation suggested that the Order should provide that not more than one-half the amount should be raised until the Board had given their consent to the borrowing of the other moiety.

Mr. *Lloyd* was then called and said the Southport Corporation had been authorized, in pursuance of the Provisional Orders granted in 1895, 1899, and 1903, to borrow £16,500. Up to the 31st of March last, they had expended £15,610 in the purchase of gas cooking-stoves. They had paid off loans amounting to £6155, and had at present standing to the credit of the gas-cooker sinking fund account the sum of £1356. The Corporation asked that they might be allowed a term of ten years within which to repay the moneys proposed to be borrowed, and that the Order should provide that not more than one moiety of the £15,000 should be borrowed without the consent of the Board.

The INSPECTOR asked why the Corporation did not apply for such amounts as the Board might sanction.

Witness replied that the gas-cooker question was getting rather a close one; but as the policy recently pursued had been more energetic, gas heating and cooking had come more to the front; and the Corporation had found their powers insufficient. No doubt it would have been better to have applied for a larger sum.

The INSPECTOR observed that when the £15,000 had been expended they would need another inquiry.

The TOWN CLERK said, with the authority of the Chairman of the Gas Committee, he would ask, upon his own responsibility, to have the application amended on the lines suggested.

The INSPECTOR said this could not be done now. If the Corporation

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 461.

Issue.	Share.	When ex Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
5 0,000	10	Oct. 13	10½	Alliance & Dublin 10 p.c.	20½—21½	..	4 17 8
100,000	10	,,	7½	Do. 7 p.c.	13—14	..	5 7 2
200,000	5	Nov. 11	6½	Bombay, Ltd.	6—6½*	..	5 0 0
140,000	5	,,	6½	Do. New, £4 paid	4½—5*	..	5 4 0
50,000	10	Aug. 31	14	Bourne- 10 p.c.	29—30	..	4 13 4
251,800	10	,,	7	mouth Gas B 7 p.c.	15—16	..	4 7 6
53,200	10	,,	6	and Water Pref. 6 p.c.	14½—15½	..	3 17 5
380,000	Stk.	Aug. 12	12	Brentford Consolidated	235 240	..	5 0 0
300,000	,,	,,	9	Do. New	178—183	..	4 18 4
50,000	,,	,,	5	Do. 5 p.c. Pref.	125—130	..	3 16 11
206,250	,,	June 10	4	Do. 4 p.c. Deb.	104—107	..	3 14 9
220,000	Stk.	Sept. 15	11	Brighton & Hove Orig.	209—214	..	5 2 10
246,320	,,	,,	8	Do. A. Ord. Stk.	150—155	..	5 3 3
400,000	20	Sept. 29	10	British	39½ - 40½	+½	4 18 9
100,600	Stk.	Aug. 12	6	Bromley, Ord. 5 p.c.	115—120	..	5 0 0
165,700	,,	,,	4½	Do. do. 3½ p.c.	90—95	..	4 14 9
500,000	10	Oct. 13	7	Buenos Ayres (New) Ltd.	11½—11¾	..	5 19 2
250,000	Stk.	June 29	4	Do. 4 p.c. Deb.	93—95	+1	4 4 3
150,000	20	July 14	8¼	Cagliari, Ltd.	22—24	..	6 17 6
100,030	10	Sept. 29	10	Cape Town & Dis., Ltd.	14½—14⅝	+½	6 15 7
100,000	10	Oct. 27	4½	Do. 4½ p c Pref.	9—9½	..	4 14 9
50,000	50	Nov. 2	6	Do. 6 p.c. 1st Mort.	51—53	..	5 13 2
50,000	Stk.	June 29	4½	Do. 4½ p.c. Deb. Stk.	98—100	..	4 10 0
1,375,000	Stk.	Aug. 31	5 5/16	Commercial 4 p c Stk.	109—111	..	4 13 9
560,000	,,	,,	5	Do. 3½ p.c. do.	105—107	+½	4 13 6
450,000	,,	June 10	3	Do. 3 p.c. Deb. Stk.	86—88	..	3 8 2
800,000	Stk.	June 10	6½†	Continental Union, Ltd.	103—106	..	6 2 8
200,000	,,	,,	7	Do. 7 p.c. Pref.	135—140	..	5 0 0
486,090	10	July 14	11	European, Ltd.	19½—20½	..	5 7 4
354,060	10	,,	11	Do. £7 10s. paid	14—15	..	5 10 0
15,243,200	Stk.	Aug. 12	4 4/16	Gas- 4 p.c. Ord.	94—95	..	4 12 7
2,600,000	,,	,,	3½	light 3½ p.c. max.	89—91	..	3 16 11
3,799,735	,,	,,	4	and 4 p.c. Con. Pref.	107—109	..	3 13 5
4,193,975	,,	June 29	3	Coke 3 p.c. Con. Deb.	87—89	..	3 7 5
258,740	Stk.	Sept. 15	5	Hastings & St. L. 3½ p.c.	90—95	..	5 5 3
70,000	10	Sept. 29	11	Hongkong & China, Ltd.	15—16	..	6 17 6
3,800,000	Stk,	Nov. 11	10	Imperial Continental	206—205*	..	4 16 2
473,600	Stk.	Aug. 12	3½	Do. 3½ p.c. Deb. Red.	96—98	+½	3 11 4
175,036	Stk.	Aug. 31	6	Lea Bridge Ord. 5 p.c.	115—120	..	5 0 0
561,000	Stk.	Aug. 31	10	Liverpool United A.	218—220	..	4 10 11
718,100	,,	,,	7	Do. do. B.	159—161	+1	4 6 11
366,083	,,	June 29	4	Do. do. Deb. Stk.	107—109	+1	3 13 5
£			p.c.				£ s. d.
75,000	5	June 29	5	Malta & Medn., Ltd.	4¾—4⅞	..	5 5 3
560,000	100	Oct. 1	5	Met. of 5 p.c. Deb.	102—104	+1	4 16 2
250,000	100	,,	4½	Melbourne 4½ p.c. Deb.	100—102	..	4 8 3
541,920	20	Nov. 11	3½	Monte Video, Ltd.	10—11*	..	6 7 3
1,515,892	Stk.	July 29	4½	Newc'tle & G'tesh'd Con.	107—103	..	4 3 4
406,725	Stk	July 1	3½	Do. 3½ p.c. Deb.	92—92½	..	3 15 8
15,000	10	Aug. 31	10	North Middlesex 10 p.c.	19—20	..	5 0 0
52,940	1	,,	7	Do. 7 p.c.	13—14	..	5 0 0
300,000	Stk.	May 12	8	Oriental, Ltd.	145—150	..	5 6 8
600,000	5	Sept. 15	7	Ottoman, Ltd.	5½—6½	..	5 12 0
235,005	Stk.	—	6⅛	Plym'th & St'house 5 p.c.	—	..	—
398,490	5	Apl. 28	5	Primitiva Ord.	5½—5¾	..	4 6 11
796,980	5	July 28	5	Do. 5 p.c. Pref.	4¾—5	..	5 0 0
488,900	100	June 1	4	Do. 4 p.c. Deb.	93—95	..	4 4 3
851,070	10	Oct. 13	7	River Plate Ord.	11½—11⅝	+⅛	5 16 8
300,000	Stk.	June 29	4	Do. 4 p.c. Deb.	94—96	..	4 3 4
250,000	10	Sept. 15	6	San Paulo, Ltd.	12—13	..	4 12 4
70,000	50	June 29	5	Do. 5 p.c. Deb.	51—53	..	4 14 4
135,000	Stk.	Sept. 15	10	Sheffield A	237—239	..	4 3 8
209,984	,,	,,	10	Do. B	235—238	..	4 4 0
523,498	,,	,,	10	Do. C	236—238	..	4 4 0
123,998	Stk.	Sept. 29	5	Shrews'bury Ord. 5 p.c.	104½—107½	..	4 13 0
70,000	10	,,	11	South African	16—17	..	6 9 5
6,250,000	Stk.	Aug. 12	5½	South Met., 4 p.c. Ord.	127—123	..	4 5 3
1,832,700	,,	July 14	3	Do. 3 p.c. Deb.	88—90	+1	3 6 8
575,000	Stk.	Aug. 31	5½	S'th Suburb'n Ord. 5 p.c.	118—123	..	4 9 5
60,000	,,	,,	5	Do. 5 p.c. Pref.	125— 25	..	4 0 0
112,533	,,	July 14	5	Do. 5 p.c. Deb. Stk.	133—138	..	3 12 6
380,940	Stk.	Nov. 11	5	Southampton Ord.	103—107*	..	4 13 6
87,950	,,	—	4	Do. 4 p.c. Deb.	—	..	—
120,000	Stk.	Aug. 31	6¼	Tottenham A 5 p.c.	120— 25	..	5 0 0
325,520	,,	,,	4¾	and B 3½ p.c.	97—102	+2	4 13 2
115,000	,,	June 29	4	Edmonton 4 p.c. Deb.	104—107	..	3 14 9
182,380	10	June 10	8	Tuscan, Ltd.	8½—8¾	..	9 2 10
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	96—98	..	5 2 0
30,000	Stk.	Aug. 31	7¾	Wands- A 5 p.c.	150—155	..	5 0 0
255,636	,,	,,	6¼	worth B 3½ p.c.	120—125	..	5 0 0
50,000	,,	,,	5 7/16	and C 3½ p.c.	102—107	..	4 18 2
59,416	,,	June 29	3	Putney 3 p.c Deb. Stk.	78—83	..	3 12 8
745,872	,,	Aug. 12	5	West Ham 5 p.c. Ord.	97—99	..	5 1 0
85,000	,,	,,	5	Do. 5 p.c. Pref.	117—122	+2	4 2 0
160,000	,,	June 29	4	Do. 4 p.c. Deb. Stk.	103—108	..	3 14 1

Prices marked * are Ex div. † Next dividend will be at this rate.

made the application after he had thrown out the suggestion it would not do.

Answering a question put by the INSPECTOR, witness said there was no doubt about the profit earned on the cookers.

The TOWN CLERK said he could call the Chairman of the Gas Committee if required; but this was their case.

The INSPECTOR declared the inquiry closed, and said he would report to the Board in due course.

Mr. Bond had prepared a statement for submission to the Inspector. It showed that there are on the books of the Corporation, 10,241 gas consumers, and, in addition, 275 empty houses are provided with piping, meters, and other necessary fittings to enable the Corporation to supply gas. The number of cookers in use at present on simple hire is 2855, and on the hire-purchase system 58. The following is a statement of the number of ordinary gas cooking-stoves fixed on hire during the eight years ended March 31, 1897-04: 617, 485, 478, 320, 424, 372, 129, 113—showing a total of 2938, at a cost of £15,738. Since the 31st of March last, nearly 2000 orders for stoves have come in. It is estimated that £7500 will be needed to meet the demand up to March 31, 1906, and the balance will be required by two instalments.

THE PRICE OF GAS AT DUKINFIELD.

Position of the Slot-Meter Consumers.

On Monday last week, a meeting of ratepayers, called by requisition, was held in the Co-operative Hall, Dukinfield, under the presidency of the then Mayor (Alderman Pratt), to consider the price charged for gas in the district. A long address on the subject was delivered by Mr. J. W. Hadfield, who moved a resolution to the effect that the prices now in force require revision, and recommending that this should be done by a reduction of 4d. per 1000 cubic feet being made to users of slot meters. The speaker pointed out that the existing prices per 1000 cubic feet are: Large consumers, according to consumption, 2s. 4d. to 2s. 8d.; small consumers through ordinary meters, 2s. 9d.; small consumers through prepayment meters, 3s. 1d. Further, he said there were upwards of 1000 slot meters in use in the town; so that the question before the meeting affected, on a rough calculation, something like 5000 men, women, and children. At a meeting of the Gas Committee held on the 25th of April last, a resolution was passed—"That the price of gas be reduced by 2d. per 1000 cubic feet as from the commencement of the current quarter," and at a meeting of the Council held on the 2nd of May this resolution was duly confirmed. He submitted that if the resolution had any meaning at all, it meant that every consumer of gas, whether small or large, through wet or dry, ordinary or slot meter, was to get a reduction in the price of the gas he consumed. The Gas Committee, however, had not yet made any reduction to penny-in-the-slot consumers; and he held they were not carrying out the spirit of the resolution. He contended that no distinction should be made in the class of consumers who were to get the reduction. The Gas Committee, however, had taken a different view, for they had issued notices from which it was evident that the only consumers who were to have the reduction were those using ordinary meters and those who were large consumers. This, he held, was unfair and unjust; for to deprive the poor penny-in-the-slot consumer of his reduction in face of the resolution quoted, was, to his mind, one of the most glaring examples of class privilege they could have in their little community; and he asked the meeting to show by their votes that they wanted justice and equity to the penny-in-the-slot consumer, and not an interpretation of a resolution which gave a favoured section of the community an advantage which ought to be granted all round. Mr. J. Sumner, seconded the motion. The Chairman inquired if anyone would like to support it, or ask Mr. Hadfield any questions; but as there was no response, the resolution was carried unanimously.

INCANDESCENT GAS LIGHTING AT ROUEN.

A recent number of "Le Gaz" contained some particulars, extracted from a report presented to the Municipal Council a few months ago, in regard to the use of the incandescent system of gas lighting for the streets and public buildings in place of the old batswing burners. The figures given are for the complete year ending Dec. 31 last.

In the twelve months covered by the report, there were 4320 incandescent burners employed in the street-lamps. They were regulated to ensure a consumption of 135, 90, and 45 litres (4·75, 3·18, and 1·58 cubic feet) of gas respectively; and they cost for the gas supplied to them 144,456 frs. (£5778), and for maintenance 24,322 frs. (£973)—together, 168,778 frs. (£6751). With the old burners, the cost would have been 201,958 frs. (£8087); so that the incandescent system effected a saving of 33,180 frs. (£1327). The total number of lighting hours was 15,163,200, and the consumption of gas 931,976 cubic metres, or 32,899,000 cubic feet. The above-named sum of 168,778 frs., distributed over the total number of lighting hours in the year, gives an average of rather more than a centime per burner per hour. The average cost for gas and maintenance for the 4320 burners is 39 frs. (31s.) each. The number of mantles replaced per lantern was, on an average, 3·27, and of chimneys 1·23; being an annual average life of 1073 hours for the mantles and 2853 hours for the chimneys.

The average cost of an incandescent burner last year was 5·63 frs. (4s. 6d.); whereas in Paris it is 13 frs. (10s. 6d.), and in Lyons 11 frs. (8s. 10d.). The number of burners in use for the public lighting, which was 4679 on Dec. 31, 1902, rose to 4690 in the course of last year. Of these, 4320 were incandescent, 146 batswing (5 and 3 cubic feet per hour), and 136 electric lamps; together with 88 incandescent lamps in the public

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gardens. The two Companies supplying the town pay the Municipality a tax of 2c. per cubic metre (5⅞d. per 1000 cubic feet) of gas sold for private consumption; and the Electricity Company pay a royalty of 15 per cent. on their gross receipts for current sold for lighting, and 7·5 per cent. on that sold for power. The revenue from this and other sources, including the *octroi* on coals, amounted last year to 456,506 frs. (£18,260); while the expenditure on public lighting was 320,336 frs. (£12,813). The Municipality consequently netted last year a round sum of 136,000 frs. (£5440) from the suppliers of light in the city.

METROPOLITAN WATER BOARD.

The Fortnightly Meeting of the Board was held on Friday, at the offices of the Metropolitan Asylums Board—Sir R. M. BEACHCROFT in the chair.

The VICE-CHAIRMAN (Mr. J. Glass) referred to the honour which had lately been conferred upon the Chairman—an honour which he said was well merited, for they knew well that Sir Richard Beachcroft had a splendid record of useful public service before he became a member of the Water Board. He thought, however, that the immediate reason which had led to the bestowal of the honour was appreciation of his services as Chairman of the Board. Mr. Glass then moved—"That this Board do offer their heartiest congratulations to their Chairman, Richard Melville Beachcroft, on the honour of knighthood conferred upon him by His Majesty the King, and place on record their cordial satisfaction at this public recognition of his unselfish and untiring devotion to the interests of the Metropolis, in whose interests he has laboured with such marked ability and success."

Mr. E. B. BARNARD, the Chairman of the Works and Stores Committee, seconded the motion, which was unanimously adopted.

The CHAIRMAN, in reply, said he looked upon the honour which had been conferred upon him as a token that the Water Board had so far justified its existence, and had made a fair start in its municipal life. It was a great encouragement to know that their efforts, at all events so far, had met with approval by the highest authority in the realm.

The Finance Committee reported that 388 tenders were received for the £1,500,000 of Metropolitan Water "B" Stock, which the Board, on the 21st ult., decided to issue. The tenders amounted to £3,010,700, and the prices at which the applications were made varied from £97 7s. 6d. to £92 10s. (the minimum price) for each £100 of stock. The average price obtained for the stock was £92 13s. 8d. The Bank of England had asked to be furnished with a copy of the resolution of the Board creating the stock; and, on the recommendation of the Committee, it was agreed to affix the seal of the Board to the resolution. The Committee also reported that they had arranged to repay at once the sum of £400,000 borrowed from the Bank for the purpose of paying the balance of the compensation to the Water Companies.

In a further report, the Finance Committee reminded the Board that certain parts of the water undertaking had been transferred to the boroughs of Croydon and Richmond, under the provisions of section 12 of the Metropolis Water Act, 1902; and they announced that the following amounts had been received in respect thereof: Croydon, £225,810; Richmond, £35,000. They had had under consideration the question of the application of these capital receipts of the Board; and they recommended that, pursuant to section 22 of the Metropolis Water Act, 1902, application should be made to the Local Government Board for their sanction to apply the sum of £260,810 towards the discharge of the compensation payable to the Water Companies. This was agreed to.

A special report of the same Committee was presented by Mr. T. L. Knight, the Vice-Chairman of the Committee. It stated that, in response to the general wish of members of the Committee, they had held a special meeting, in the absence of their Chairman (Lord Welby), with a view to formulating an expression of their appreciation of the great services he had rendered, not only to the Board, but to the Metropolis at large, in that capacity. They thought the members would recognize that Lord Welby had undertaken the chairmanship of the Committee at a critical period of the Board's existence; and they had passed a resolution conveying to him their deep sense of the services he had rendered in bringing to a successful issue negotiations which had resulted in the discharge of the huge sum payable as compensation to the Water Companies, with satisfaction, they thought, to all parties, and without disturbance to the Money Market. In presenting the report, Mr. Knight proposed the following resolution: "That the Board desire to record the high appreciation of the services of the Chairman of the Finance Committee, Lord Welby, in the prolonged, complicated, and difficult negotiations in connection with the discharge of the great capital sums payable by the Board to the Water Companies. His unrivalled experience and the devotion to the interests of the public which he displayed contributed greatly to their successful completion." The motion was seconded by Mr. T. Chamberlen and cordially supported. After a few remarks by Lord Welby in acknowledgement, the resolution was unanimously agreed to.

The General Purposes Committee submitted a report in regard to the appointment of an Assistant Clerk; and they recommended that the position should be conferred upon Mr. W. J. G. Norris, at present the chief official in the Clerks' Department, at a salary of £500 a year. This was agreed to.

On the recommendation of the Works and Stores Committee, the Board agreed that the works under the award of Sir A. R. Binnie and Mr. G. R. Strachan in connection with the severance of the borough of Croydon from the Board's area should be deferred for the present; that the arrangements in existence before the appointed day for the supply of water to the Lambeth area transferred to Croydon should be continued from Sept. 29, 1904, until otherwise determined; and that payment for the water so supplied to the Croydon Corporation should be at the rate of £4000 per annum.

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PORT ELIZABETH WATER SUPPLY.

The New Scheme.

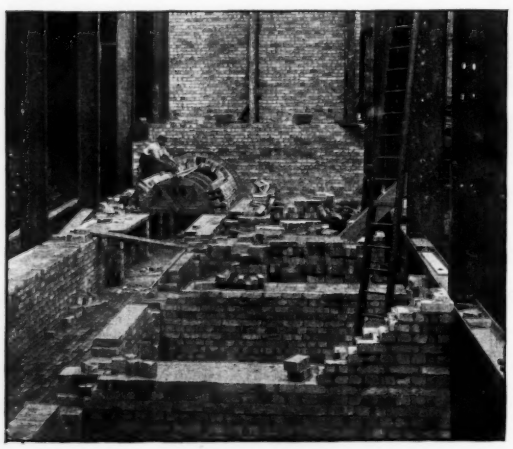
A visit of inspection was recently paid by the Mayor (Mr. J. C. Hemsley, J.P.) and the members of the Municipal Council to the new water-works which are being constructed, at an estimated cost of £360,000, for the supply of Port Elizabeth. They were accompanied by the Town Clerk (Mr. D. Walker), the Town Engineer (Mr. A. S. Butterworth), and the Hydraulic Engineer (Mr. W. Ingham, formerly of Torquay).

The new scheme is for impounding the waters of the Sand, Palmiet, and Bulk Rivers, which are tributaries of the Elands River. Dam No. 1 is being constructed immediately below the junction of the Sand and Palmiet Rivers, and is 12½ miles in a direct line from Van Staaden's reservoir. Dam No. 2 is situated on the Bulk River, about 7¼ miles away from Sand River dam, and a little over 5 miles from Van Staaden's. The pipes from the Sand reservoir will be 18 and 16½ inches in diameter, and the length 9 miles. The pipe from the Bulk reservoir is 9 inches in diameter, and the length 2 miles. These pipe-lines will meet at the filter-beds, from which there will only be one line of pipes to Port Elizabeth, ranging from 17½ to 12 inches in diameter. About half-a-mile from the filter-beds is a tunnel (now under construction), 1280 feet long, 6 feet high, and 5 feet wide. The total length of the main pipe-line will be 36½ miles, and the Bulk River section 2 miles, or 38½ miles altogether. At the Port Elizabeth end of the pipe-line, a service reservoir will be constructed, with a capacity of 1½ million gallons, and will be designed so as to be an ornamental feature of the park, with a fountain playing in the centre. It is the intention to construct the Sand River dam first, but at the same time to lay the section (15½ miles) of pipes between the Bulk River and Green Bushes break-pressure tank, so as to give a supplemental supply before the whole scheme is completed. The scheme also embraces a dam across the Bulk River, the wall of which will be curved instead of straight, which will give additional strength. The catchment areas are as follows: Sand River, 11·47 square miles; Palmiet River, 8·94 square miles; and Bulk River, 11·22 square miles. The following figures will also be of interest: Sand River reservoir—capacity, 140 million gallons; top water area, 40 acres; height of dam, 50 feet; width of base, 36 feet; length of overflow, 150 feet; two outlet culverts, 7 ft. 6 in. diameter. Bulk River reservoir—capacity, 50 million gallons; top water area, 14 acres; height of dam, 45 feet. In dry weather, the average flow of water in the Sand and Palmiet Rivers is about 253,000 gallons a day, and varies up to 1500 million gallons; while the respective figures for the Bulk River are about 86,000 and 800 million gallons per day. The works were commenced in February last, and it is estimated that they will be completed by the end of 1907; but within 15 or 18 months a supplementary supply of water will be sent into the town through the pipes from this source—the pipes from Sand River connecting with the present pipe-track at Green Bushes. When laying the foundation stone, the Mayor remarked that the works were in the hands of Mr. Ingham, to whose capabilities he paid the highest possible compliments. He also said that the Corporation did not look upon the remuneration Mr. Ingham was being paid as adequate. They wished him to feel that he had added to the lustre he had gained in the Old Country, and that in carrying the work to a successful issue his services would not be forgotten by the Council.

THE NEW WATER-WORKS FOR PAIGNTON.

More Capital Required.

A statement as to the financial position of the new water-works which are being constructed by the Paignton Urban District Council was laid before that body yesterday week, and showed that the cost will largely exceed the parliamentary estimate. In the Act authorizing the construction of the works, power was given to raise £70,000; the estimate being £27,853 for making the dam, £33,027 for the pipe-line from Dartmoor to the town, and £9120 for establishment, engineering, and other expenses. Mr. W. J. Ham, the Chairman of the Water Committee, explained that these were mere approximate estimates. Up to the present, £62,673 has been borrowed, and £54,814 actually paid; while £6000 is due to the contractors, but is held as guarantee until the completion of the contract. To complete the contract, it is estimated that £50,334 will be required, of which sum £26,619 is on account of the dam, and £16,786 for the pipe-line; the balance being made up of engineering and other charges, including £5000 for the extension of the main to Brixham, which is to pay for the supply in bulk. Mr. Ham said the work was much delayed in its early stages through bad weather, which increased the cost; but the chief cause of the large expenditure was the number of cracks and fissures met with in getting out the foundations for the dam. These cracks had either to be blasted out or tunnelled and filled with concrete; and the cost worked out to an extra £22,609, out of a total expenditure of £60,814 to Sept. 29. Another cause of the increase is that the size of the pipe-line has been altered from 8 inches, which was originally reckoned for, to 9 inches. This change is largely explained by the fact that the Council have entered into arrangements for the supply of water to Teignmouth and Brixham. It was estimated that the works would be completed about May, 1906; and the Council were under agreement to furnish a supply to Teignmouth in July of that year. In the meantime, there would be an increased charge on the rates of Paignton for interest and sinking fund; but when the works were completed and earning revenue, the rates would drop to the present level or below it. Mr. Westlake thought that, in fairness to the Engineers, it should be made quite clear that a large portion of the cost was due to the increase in the size of the main from 8 to 9 inches, and also to raising the height of the dam above the level originally contemplated. It was decided to print the statement for the information of the ratepayers.



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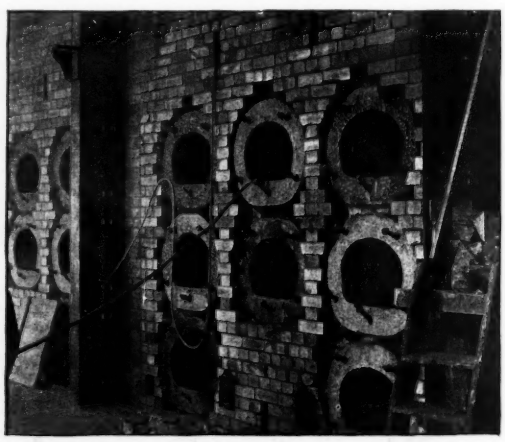

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From Our Own Correspondent.

Saturday.

Always reserving the fundamental question of the right and wrong of municipal trading, which may ever remain matter of dispute, and as to which the last word has not been said, it must be the opinion of everyone who peruses the replies given by Mr. W. R. Herring to the statements and complaints of the traders of Edinburgh and Leith regarding the action of the Edinburgh and Leith Gas Commissioners, given on another page of the "JOURNAL," that a most complete answer has been returned to all that was put forward by the traders. More particularly is this the case with reference to the charges—for such they were—that the Commissioners' employees were doing work in the fitting up of appliances free of charge, and that they were wastefully negligent of the Commissioners' property. These allegations have been so thoroughly exploded that it is almost impossible to conceive that they can be repeated, or even referred to. The latter averment, as read by everyone, was that the workmen of the Commissioners went to a house to fit up appliances, and that when they had finished their work, they left behind them a quantity of piping and other materials which it was said was of such value in one instance that it was almost equal to a year's rent of the appliances hired. Nothing could be more misleading. All that has been found to have taken place was that when workmen went to remove a stove, they did not also take away the service-pipe, but left it, in the expectation that it would be again required; the pipe remaining all the while the property of the Gas Commissioners. The other allegation that incandescent burners were fitted up free of charge resolves itself into no more than this—that two shops were selected for display purposes, in one of which an installation was maintained for seven months, and was then withdrawn at the request of the occupier, and in the other the material provided has amounted to one mantle in a year-and-a-half—not a very deadly outlay to the Commissioners, nor loss to the traders, even granting that the transaction was outside the duties of the Commissioners; but that in all the other instances cited the installations were charged and paid for. Then Mr. Herring brings out, not only that the Stove Department has been all along carried on at a profit, but that, even upon their own showing, the loss sustained by the traders must have been infinitesimal. He also exposes, by authentic information, the attempt to get up a case against the Commissioners by setting forth what is being done in other places. Upon this head the reply is most conclusive—so much so that we must, in charity, conclude that the traders were badly informed upon the subjects they talked of. It is not necessary to go further into the matter at present. Mr. Herring has satisfied the specially appointed Committee—all save one—that the policy of the Commissioners is right. There may be some little discussion upon the recommendations of the Sub-Committee when they come before the Commissioners; but that they will be adopted there need be no doubt. As to these recommendations, it is only fair to the traders to admit that their action is likely to result in the practice of giving discount to traders being placed upon a basis which will be applicable to all.

The Monifieth Town Council on Tuesday had before them a proposal to confirm the resolution come to last month to adopt the Burghs Gas Supply Acts. Provost Stewart explained that, by confirming the resolution, the Council would be in a position to negotiate for the acquisition of the Gas Company's undertaking. After some discussion, the resolution was unanimously confirmed.

The Dundee Town Council having some time ago resolved that gas-meters supplied by them should be tested in Dundee instead of in Edinburgh, the Committee appointed to make arrangements for this being done met on Wednesday, to consider whether the work should be carried out in the office of the Inspector of Weights and Measures, or at the gas-works, by Mr. Nicol, the City's Inspector. They decided that the work should be done at the gas-works, and instructed the Gas Engineer to have a room set apart and fitted up with the necessary apparatus for the purpose.

A narrow escape from suffocation by gas is reported from Galashiels. Two sisters, Mary and Lizzie Shiel, mill workers, lived together in a house in Island Street. Shortly after six o'clock on Sunday morning last, one of them awoke, and being conscious of a strong smell of gas, got out of bed; but in doing so she was overcome by the gas, and fell to the floor unconscious. The noise of her fall was fortunately heard by neighbours, who, suspecting that something was wrong, entered the house, when they found both women unconscious. Medical assistance was procured; and they were brought round, but with difficulty. In searching for the cause, a serious break in the main in the street was discovered, the escaping gas from which had penetrated the house.

Mr. Hugh Marshall, D.Sc., F.R.S., of Edinburgh, has been awarded by the Royal Scottish Society of Arts, a Keith Prize, value £5, for a paper read by him before the Society on the 23rd of November last, entitled "Improvements Relating to the Use of Carburetted Air for Lighting and other Purposes." The paper was descriptive of Dr. Marshall's methods of applying the Notkin process of making air gas from oil.

The Corporation of Dundee, as Water Commissioners, to-day give notice of their intention to apply to the Secretary for Scotland, under the Private Legislation Procedure (Scotland) Act, 1899, for a Provisional Order giving them extended powers. The principal object of the Provisional Order is the incorporation of Carnoustie and the district into the compulsory area of supply, and the acquisition of the existing water-works for the supply of the burgh of Carnoustie, which steps are in accordance with an agreement between the two Corporations. Fuller powers for the carrying on of the undertaking, and further borrowing powers, are also asked. It was probably a peep into the preparations for this application which enabled the Dundee newspapers on Wednesday to give a series of statistics as to water supply. First there was a table showing the storage of water in the reservoirs belonging to the Corporation at this period in each of the past five

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years. At the present time, it is brought out, there is water in store equal to the supply of the city and district for 200 days. Then there is another table, which must have taken some trouble to compile, in which the working expenses in the Water Departments of twelve towns are given, in total and by percentage of rental. Only the latter is of consequence. It is as follows: Aberdeen, 33·8; Belfast, 27·3; Birmingham, 40·1; Blackburn, 24·8; Bolton, 28·4; Dundee, 24·1; Edinburgh, 30·7; Glasgow, 33·3; Hull, 37·5; Liverpool, 31·9; Manchester, 34 0; and Paisley, 33·7. Dundee is thus the lowest of all, which is an excellent point to make before a Parliamentary Commission, as showing the careful way in which things are managed in Dundee, and the reserve of power they now have.

This has been an exceedingly rainless season, particularly during the last two months. The drought, as might have been expected, has begun to tell upon water supplies; but, of course, with the advent of winter, there is much less anxiety on the part of local authorities than there would have been had a similar state of matters existed at an earlier period of the year. There is one exception, which is at Arbroath, where the water supply is at all times inadequate. The scarcity of water was mentioned by Mr. Robertson, the Convener of the Water Committee, at a meeting of the Town Council at the end of last week. He said they were at their wits' end for water to supply the community. The Engineer in charge of the pumping-station had that night informed him that if the present rate of supply and consumption were kept up, they would be entirely without water in a week's time. He asked power to cut off the water supply at any time when it should be found to be necessary. He assured the Council, however, that the public would get the benefit of all the water in the wells as long as possible, consistent with saving the town from a water famine. The Council gave the power sought.

Lighting London Bridge Approach.—The Southwark Borough Council agreed last Wednesday to a suggestion by the Bridge House Estates Committee that the latter body should erect new lanterns and burners on the southern approach to London Bridge, so that it should be lighted in a similar manner to the bridge. The Council on their part will contract to light and keep in repair the new lanterns and burners.

Resumption of a Full Supply of Water to Manchester.—There is now in the Longdendale reservoirs of the Manchester Corporation a quantity of water sufficient to last the area of supply for 51 days, as compared with the calculation of 17 days' stock little more than a week ago. From Monday to Thursday morning there was a rainfall of 2·09 inches. In consideration of existing circumstances, and of the probability of a continuance of rain, the Water Committee resolved to give the full supply to consumers on and after Sunday last. For the past seven weeks, since the 25th of September, there has been a daily shutting off first for 11 and then for 10 hours out of each 24 hours. The second pipe from Thirlmere is now bringing its full quantity of 12 million gallons of water daily with perfect satisfaction.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Nov.* 12.

Sulphate of Ammonia.

The greater activity referred to in our last report has been sustained throughout the week, and has resulted in a further advance in values; the closing quotations being £12 8s. 9d. to £12 10s. per ton f.o.b. Hull, and £12 10s. to £12 12s. 6d. per ton f.o.b. Liverpool and Leith. It is satisfactory to note that there has been a larger proportion of direct buying, indicating that consumers abroad have abandoned the hope of a reaction. There has also been buying for December delivery, at a premium of about 2s. 6d. per ton on spot prices. In the forward position, buyers have advanced to makers' recent ideas, but too late; £13 per ton being now required f.o.b. Leith for January-June delivery. For July-December, £12 10s. is asked.

Nitrate of Soda.

This article is increasingly firm, especially in the forward position, though spot prices remain at 10s. 9d. and 11s. per cwt., for ordinary and refined qualities respectively.

LONDON, *Nov.* 12.

Tar Products.

The market continues strong, and as a rule closes with a firmer tone. Further sales in benzol are reported at 10⅛d. for 90 per cent. f.o b. London; while some 50-90 per cent. is said to have been sold at 8d. per gallon in the North. A small quantity of toluol was sold at 7d. per gallon for early shipment from London; but there is not much doing in this article. In solvent naphtha, the market continues firm, and the demand is good. There is also a fairly strong inquiry for forward delivery, especially for home consumption in the London district. In anthracene, the market is decidedly quiet, and consumers decline to purchase except at a reduction on the price last quoted for "A" quality; while as regards "B," it is absolutely unsaleable. The demand for creosote in London continues very good; and prices are well maintained. In the North, however, there is certainly more offering, and makers appear very desirous of selling for early delivery. In carbolic acid, the demand is very strong for prompt delivery; and during the past week business has been done over the first six months of next year at improved prices. One or two of the largest makers report sales at 2s. 3d. for January-June; and it is quite expected that further business will be done at this price. In crystals, business continues brisk; but producers are rather chary of making offers for forward delivery, as so much uncertainty prevails as to the value of crude. Pitch is very firm. London distillers report a very strong market, with sales absolutely concluded at 34s. 3d. per ton, and now as a rule quote 35s., though disinclined to sell even at this figure, and in some instances even higher prices are asked. The demand for Yorkshire makes continues strong, and dealers report sales at very good

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prices. In South Wales, the demand is still brisk, but principally for forward delivery; consumers appearing evidently well supplied as regards the present year.

The average values during the week were: Tar, 17s. 6d. to 21s. 6d. Pitch, London, 33s. 6d. to 34s.; east coast, 32s. to 32s. 6d.; west coast, 30s. to 31s. Benzol, 90 per cent., 10½d.; 50-90 per cent., 7½d. to 8d. Toluol, 7d. to 7½d. Crude naphtha, 3½d.; solvent naphtha, 8½d. to 9d.; heavy naphtha, 10d. to 10½d. Creosote, London, 1d. to 1⅛d. Heavy oils, 2⅛d. to 2¼d. Carbolic acid, 60 per cent., 2s. 2d. to 2s. 3d. Refined naphthalene, £4 10s. to £9; salts, 21s. to 22s. 6d. Anthracene, "A" quality, 1⅜d. to 1¾d.

Sulphate of Ammonia.

The market has been very firm during the past week, and values have been well maintained for both prompt and forward delivery. London producers are really not offering anything at the moment. The South Metropolitan are reported to have sold at £12 15s. on their own special terms; but Beckton have declined to make offers. In Hull, sales have been made at £12 6s. 3d.-£12 7s. 6d. for prompt shipment; but for December delivery £12 10s. is reported to have been paid. In Leith, there is still a strong demand; and it is reported that some Scotch makers have declined £12 11s. 3d., and that £12 12s. 6d. has actually been paid, which certainly seems rather a high figure. As regards forward delivery, very high prices indeed are being talked of for January-June.

The Dangers of Acetylene.—Mr. Matthew Brennand, the sexton of the Parish Church, Holme, South Westmorland, last Wednesday evening sustained shocking injuries through an explosion of acetylene gas, plant for the manufacture of which he had on his tailoring premises. Some of the pieces struck him in the face; and his injuries were of such a character that his life was despaired of. The workshop was ruined.

Felixstowe District Council and Electric Lighting.—After five years' negotiation, the Felixstowe and Walton Urban District Council have completed the purchase of the undertaking of the Suffolk Electricity Supply Company, and embarked upon their first venture in municipal trading. The business matters were concluded at the Town Hall on the 4th inst., and afterwards a move was made to the works, which were formally handed over to the Council by the Chairman of the Company (Mr. P. C. N. Peddar) nailing a brass plate, bearing the Council's name, to the entrance. The event was celebrated by a luncheon at the Bath Hotel. By the terms of the agreement entered into, the Council are relieved of all responsibility in the working of the plant, and it really amounts to the Company becoming lessees of the works and giving to the Council, in the nature of rent, 6 per cent. on the capital expenditure, which, it is estimated, will pay both the interest on the purchase money and the sinking fund, so that in 25 years the Council will take over the works practically free of cost, without any payment for goodwill or compensation for loss of future profits.

COAL TRADE REPORTS.

Lancashire Coal Trade.

There has been a noticeable improvement in the sales of house coal; but, owing to the temperate weather prevailing, the demand has only been of a moderate character. Dealers are holding firm to current rates; but there is no immediate prospect of an increase in prices. Coal for steam and locomotive purposes is in fair request. More coal is also going to certain iron-works in the district, where business shows an increase. Slack and burgy coals are eagerly sought for, and the pits find a difficulty in meeting the demand. The winter requirements of gas coal and cannel cause a brisk trade in these qualities. Coal for shipping shows an increase; something like from 15,000 to 20,000 tons per week being loaded at the Partington and Cadished tips on the Manchester Ship Canal. Coke is rather quiet. Prices are the same as last week. It seems to be a settled conviction on the part of colliery owners and their men that there is no prospect of an increase in wages for the next three months.

Northern Coal Trade.

There is a rather irregular demand for steam coals; the inquiry from the Baltic having fallen off. But more is being sent to the south of Europe and also to the East. Best Northumbrian steam coals are quiet at 9s. per ton f.o.b., second-class steams are from 8s. to 8s. 4½d., and steam smalls are from 4s. to 4s. 6d. The collieries are fairly well employed; but there is no pressure of work. In the gas coal trade, there is a growth in the consumptive demand, which is now near to its maximum, so that the best collieries have little coal for sale beyond their contract quantities, though there is rather more second-class gas coal on offer. The prices generally are from 7s. 10½d. to 8s. 4½d. per ton for Durham gas coals f.o.b., though here again there are a few collieries who ask prices that are higher. In coke, the tone of the market is firmer, but the production of gas coke is increasing. Some gas coke is quoted at 13s. per ton f.o.b. on the Tyne; but lower prices are occasionally named, and the inland works are in some instances increasing stocks.

Scotch Coal Trade.

In the course of the past week, the Scottish Coal Trade Conciliation Board met in Glasgow, and adopted conditions of agreement, which have yet to be accepetd by the constituents of the respective parties, but which, if accepted, it is announced, will ensure a prolonged period of peace in the coal trade. This, it may be expected, will have the effect of improving trade, as it will give coalowners a freer hand. Meantime it cannot be said that, as yet, any improvement has been noted—in fact, there has been a good deal of idle time at some collieries. Ell is the most difficult to sell; splint is in greatest demand. The prices quoted are: Main 7s. 3d. to 7s. 6d. per ton f.o.b. Glasgow, ell 8s. to 9s., and splint 9s. to 9s. 3d. The shipments for the week amounted to 230,329 tons—a decrease of 27,206 tons upon the preceding week, but an

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	Cub. Ft. Daily.		Cub. Ft. Daily.		Cub. Ft. Daily.
BLACKBURN.	1,250,000	ST. CATHERINES (Remodelled) .	250,000	TONBRIDGE	300,000
WINDSOR ST. WORKS, BIRMINGHAM	2,000,000	KINGSTON, PA.	125,000	STRETFORD	500,000
SALTLEY WORKS, BIRMINGHAM	2,000,000	PETERBOROUGH, ONT. . .	250,000	OLDBURY	300,000
COLCHESTER	300,000	WILKESBARRE, PA. . . .	750,000	TODMORDEN	500,000
BIRKENHEAD	2,250,000	ST. CATHERINES (2nd Cont) .	250,000	SALTLEY, BIRMINGHAM (Third Contract)	2,000,000
SWINDON (New Swindon Gas Co.)	120,000	BUFFALO, N.Y.	2,000,000	YORK (Second Contract) . .	750,000
SALTLEY, BIRMINGHAM (Second Contract)	2,000,000	WINNIPEG, MAN.	500,000	ROCHESTER (Second Contract) .	500,000
WINDSOR ST., BIRMINGHAM (Second Contract) . . .	2,000,000	COLCHESTER (Second Contract)	300,000	NEWPORT (MON.)	250,000
HALIFAX	1,000,000	YORK	750,000	TOKIO, JAPAN	1,000,000
TORONTO	250,000	ROCHESTER	500,000	PERNAMBUCO (Brazil) . .	125,000
OTTAWA	250,000	KINGSTON, ONT.	300,000	MALTON	150,000
LINDSAY (Remodelled) . .	125,000	CRYSTAL PALACE DISTRICT .	2,000,000	DULUTH, MINN. (2nd Cont) .	300,000
MONTREAL	500,000	DULUTH, MINN.	300,000	BROCKVILLE (ONT.) . . .	250,000
TORONTO (Second Contract Remodelled)	2,000,000	CATERHAM	150,000	SMETHWICK	500,000
BELLEVILLE	250,000	LEICESTER	2,000,000	GRAVESEND	300,000
OTTAWA (Second Contract).	250,000	ENSCHEDE (HOLLAND) . .	150,000	NEWPORT MON. (Second Contract)	250,000
BRANTFORD (Remodelled) .	200,000	BUENOS AYRES (RIVER PLATE CO.)	700,000	TORONTO (Third Contract) . .	750,000
		BURNLEY	1,500,000	TORONTO (Fourth Contract) .	1,000,000
		KINGSTON-ON-THAMES . .	1,750,000	MONTREAL, ONT. (2nd Cont.) .	1,800,000
		ACCRINGTON.	500,000	HAMILTON, ONT.	400,000

LEEDS, 1,800,000 C. Ft. LEICESTER (2nd Cont.), 1,000,000 C. Ft. NEWCASTLE-ON-TYNE, 1,800,000 C. Ft.

AND, IN ADDITION, 4,000,000 CUBIC FEET DAILY; also Coal-Gas Plants at NELSON, B.C., CHATHAM, BERLIN, NAPANEE, OWEN SOUND, CALGARY, and WINNIPEG.

increase of 15,919 tons upon the corresponding week of last year. For the year to date, the total shipments have been 9,938,006 tons—an increase of 361,257 tons upon the corresponding period of last year.

Projected Water-Works Extension at Southport.—The Southport, Birkdale, and West Lancashire Joint Water Board are about to promote a Bill with the object of obtaining enlarged powers. It is intended to purchase from Lord Derby land near Ormskirk, and to erect additional pumping-stations. It is calculated that at the present rate of progress there will then be sufficient water to meet requirements for the next 20 years. A good many fresh powers will be sought under the Bill to expedite the working of the undertaking.

Otley District Council and the Gas-Works.—The Otley District Council had under their consideration on Monday last week the question of the purchase of the gas-works. It was stated by members of a Committee appointed to interview the Directors of the Gas Company that the latter were unwilling sellers, and they declined to state a price. It would, therefore, be absolutely necessary to go to arbitration. Mr. R. Elliott, a member of the Council, intimated that the present selling price of the £100 stock was £117, to which would be added 10 per cent. for compulsory purchase, bringing the total to £128. Then there would be the arbitration expenses. He should like to know how they were going to relieve the rates if the gas-works were bought at this figure. It was stated that an attempt would first be made to purchase the works by arrangement; and if this failed the Council would resort to arbitration.

The Rivington Watershed Arbitration Award.—At the meeting of the Liverpool Corporation Water Committee, on Friday, Alderman Burgess referred to the Umpire's award in the arbitration case between Mr. W. H. Lever, of Port Sunlight, and the Corporation, in reference to the acquisition of land on the Rivington watershed. By the award, as stated in the "JOURNAL" last week, the Corporation have to pay Mr. Lever £138,000. Alderman Burgess said the Corporation had acted all along on the best advice, employing the best valuers; and the valuation of these experts, roughly speaking, was about £30,000. The Corporation made Mr. Lever an offer of £40,000, though some members of the Committee thought they were going farther than they had a right to go. He could only say that the award of £138,000 was utterly inexplicable, and such awards were, to his mind, calculated to deter public authorities who had to deal with the purity of their water supplies throughout the country from doing their best for the communities whom they had to provide with water, by securing the protection of the watersheds. He felt strongly that they had been called upon to pay a very much larger amount than they ought to pay for this property. Mr. J. G. Wood, as an experienced Engineer, thought the award ought not to have been more than £55,000. He considered that there had been a great mistake.

Continental Union Gas Company.—The Directors of this Company will recommend to the proprietors, at the general meeting to be held on the 13th prox., dividends for the half year of 3½ per cent. on the ordinary stock, free of income-tax, and 3½ per cent. on the preference stock, less income-tax; making for the year 6½ per cent. on the former, and 7 per cent. on the latter.

Exeter Gas Company's Appeal.—At a meeting of the Exeter Board of Guardians last Tuesday, Mr. Surridge, Chairman of the Assessment Committee, moved that they be empowered to pay the bill of costs of Mr. Daw, Solicitor to the Gas Company, in connection with the recent appeal. He said the original bill was £729 13s. 3d.; but the Taxing Master had taken off £454 12s. 11d.—leaving £275 0s. 4d. for the city to pay. The motion was carried.

New Issues of Gas and Water Stock.—The Directors of the Tottenham and Edmonton Gas Company are about to issue to the proprietors of stock, residents, and gas consumers in the district, £12,500 of additional "B" stock (being a portion of the amount authorized at an extraordinary general meeting held on the 20th of February last), at a minimum price of £100 per cent. The present dividend on this stock is 4¾ per cent. Friday is the last day for submitting tenders. The Directors of the Sutton District Water Company are inviting tenders for £25,000 (nominal) of 4½ per cent. preference stock.

Electric Lighting Losses.—Commenting on municipal losses on light, the "Daily Express" says: "It has been ascertained that during last year 66 of the municipal bodies in the British Isles which supply electricity showed a deficit; 75 other towns showed a profit; and a few just made ends meet. The 66 municipalities which showed a deficit had losses totalling £76,201. The chief losses were: Battersea, £2688; Cheltenham, £3740; Dublin, £5524; Glasgow, £13,896; Keighley, £2227; Maidstone, £3162; Morecambe, £2026; Paisley, £3068; Salford, £2394; Wigan, £3194. Some of these towns are in the early years of their municipal electricity; but that is no guarantee that they will soon turn their losses into profit."

Gas Beats Electricity in the Thames Valley.—The Hampton Wick District Council considered at their last meeting the following tenders for street lighting, &c.: Twickenham and Teddington Electric Supply Company: ½ ampere Nernst lamps of 80-candle power, £3 10s. per annum; power, 1½d. per unit. Hampton Court Gas Company, for one year, £3 8s. 6d. per lamp; for three years, £3 8s. per lamp per annum; for five years, £3 7s. 6d. per lamp per annum, except for the high-power lights at Kingston Bridge, for which the charge would be £6 17s. per lamp per annum. For power, the Company would allow the following discounts on the price of gas used: If the first offer, as above, was accepted, 2½ per cent.; if the second, 3½ per cent.; if the third, 5 per cent. The tender of the Gas Company was accepted for five years. The Kingston Town Council have sealed an agreement with the Kingston Gas Company for the lighting of the public street-lamps for the year at a charge of £3 5s. each; the painting of the columns to be done by the Council.

Southport Water Board's Accounts.—The Finance Committee o the Southport Corporation have given the Southport, Birkdale, and West Lancashire Joint Water Board three months' notice to repay a loan of £20,000 granted to them out of the balance to the credit of the Committee. There is now a debit balance of £29,666; so that even after the loan is repaid, there will be a deficit of £9666.

Incandescent Gas Lighting in London Schools.—At the meeting of the London County Council last Tuesday, a recommendation by the Education Committee to improve the lighting in sixteen schools in various districts of the Metropolis, by the adoption of incandescent gas-burners, at a cost not exceeding £1400, was adopted. The burners will be rearranged so as to secure an equal distribution of light over the desks.

Oriental Gas Company, Limited.—At the meeting of this Company to-morrow, the Directors will report that during the year ended the 30th of June the operations of the Company were marked by the steady general progress which has been a distinguishing feature of the working in the past. The gas-rental advanced £3692—an increase of 6¼ per cent. over the preceding twelve months. There was an improvement in the sales of tar; but coke did not sell so well. The total revenue for the year, however, increased by £2177. Owing to more favourable contracts having been entered into, the cost of coal carbonized was less per ton than in the preceding year. The accounts accompanying the report show that the reserve fund now stands at £50,000, which is all invested in first-class securities, and represents their market value on the 30th of June last. The balance of the profit and loss account (after payment of the interim dividend of 3½ per cent. and the income-tax) is £20,103 16s. 3d., out of which the Directors recommend a dividend of 4½ per cent., f ee of income-tax; making a total of 8 per cent. for the year, and leaving a balance of £6603 16s. 3d. to be carried forward.

French Company for the Manufacture of Meters and Gas-Works Plant.—The accounts submitted at the last ordinary general meeting of this Company showed a profit of 3,450,737 frs. (£138,029); being 75,573 frs. (£3023) more than in the preceding year. Adding the balance brought forward—viz., 266,030 frs. (£10,641)—there was produced a sum of 3,716,767 frs. (£148,670) available for distribution. After meeting all claims, there was left a balance of 270,726 frs. (£10,829) to be carried forward. It was stated in the course of the proceedings that the "Duplex" meter had rapidly achieved success. On April 30, 1903, the number sold was 2500, whereas on the corresponding date this year it had reached 12,800; while on the 30th of June it was 20,300. The use of water-gas plant was extending, and the Company had been commissioned to put up three new installations—one being in Rome. Two contracts had been entered into with the Paris Suburban Gas Company, one of which was for the supply of plant for new works in course of construction at Gennevilliers. The accounts were passed, and the dividend was fixed at 80 frs. per share; being an increase of 5 frs. on that declared last ye1r.

Improved Lighting at Barnard Castle.—The pleasant inland health resort of Barnard Castle may claim to be in the van of progress in the matter of lighting. For a year past the streets have been lighted by the Gas Company with new lamps (by Edgar, of Hammersmith) and incandescent burners, governed by the Automatic Light Controlling Company's apparatus; while at the principal street corners Welsbach self intensifying lamps produce a very brilliant effect. In the parish church a great improvement has been made in the lighting; numerous old flat-flame burners being replaced by a greatly reduced number of inverted burners, with new fittings designed by the Gas Company's Secretary (Mr. Robert Wood). They have been much admired; the light being brilliant and soft, with a great economy in the consumption of gas. The Lucas light has been introduced into the Music Hall and Mechanics' Institute; while many tradesmen and householders have adopted the inverted burner, in various forms, and other improvements as a result of a gas exhibition held in the Music Hall last spring. The Bursar of the North-Eastern County School has devised an arrangement of incandescent gas-burners and reflectors by which he has secured a bright and soft shadowless light (the source being hidden) for class rooms; and we learn that it is most delightful to work by. The Company, formed in 1834, have this year been incorporated by Act of Parliament; and they are taking vigorous steps to develop their business.

Lecture on Coal Gas.—On Monday evening last week, Mr. J. G. Tooms, the Manager of the Waterford Gas-Works, gave a lecture to the members of the Essay and Debating Class of the Waterford Young Men's Christian Association, on "Coal Gas and its Uses." It was preceded by a practical demonstration in gas manufacture at the works. Mr. Tooms dealt first with the formation of coal seams, and the different qualities of coal and their relative degrees of usefulness for heating and gas-making purposes. He then passed on to refer to the discovery of gas by Murdoch rather more than a century ago, and the gas-lighting trials carried out by him; and traced the progress made up to the present day. Coming nearer home, he said there was some doubt as to where gas had been first used in Ireland; but from information he had gained from a Waterford newspaper, published in 1813, he had no doubt that Waterford was the first place in Ireland where it was employed at that time. Commenting on the lighting of Westminster Bridge, the newspaper stated that this kind of lighting had been used for some time in Messrs. Graham's foundry at Waterford, and was found more cleanly, as efficient, and as cheap as other forms of lighting. He had no doubt either, from a minute contained in the Vestry-book of Waterford Cathedral, that the streets of the city were the first public streets in Ireland lighted by gas, and were fully two years ahead of Dublin in this respect. Mr. Tooms then went minutely into the subject of the manufacture and uses of gas, and illustrated the advances made within recent years to develop its lighting power; mentioning particularly the great success which has attended the invention of the incandescent mantle and burner. He concluded by making an interesting comparison between electric and gas lighting, showing how the latter is still the cheaper form. He also dealt with the bye-products of gas manufacture, and detailed the many uses to which they are put. A hearty vote of thanks was accorded to Mr. Tooms.

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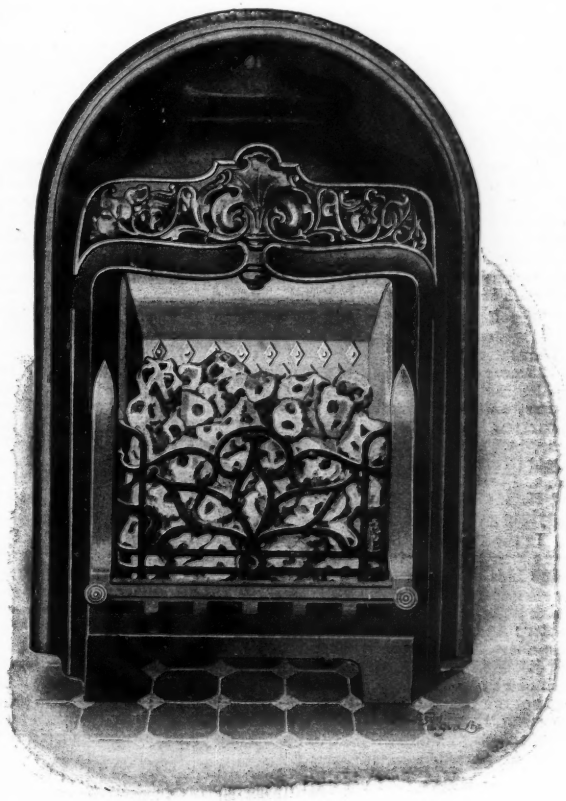

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Messrs. Biggs, Wall, and Co. have secured a repeat order for retort-settings from the Castlebar Gas Company.

The Standard Oil Company are just completing the last link in the great pipe-line from Indian territory to the Atlantic coast of the United States. It will be nearly 1000 miles long, and, when finished, will have cost £17,000,000.

The Rhondda Urban District Council have placed an order with Messrs. Robert Dempster and Sons, Limited, of Elland, for a steel tank 47 feet diameter by 10 feet deep, and another steel tank, 14 feet long by 8 feet wide by 5 feet deep, for storage purposes.

The Chemical Engineering Company and Wilton's Patent Furnace Company have been favoured with a contract from the Powell Duffryn Steam Coal Company, Limited, for the supply and erection of a complete sulphuric acid and sulphate of ammonia plant, with buildings, for their Bargold Colliery.

The Markets Committee of the Halifax Corporation have decided, with a view to the better lighting of the Markets, to fix there six sample incandescent gas-lamps. It was a question whether gas or electricity should be installed, both being supplied by the Corporation. It is admitted that the Committee, in deciding for gas, considered the difference in the cost of the two illuminants.

The Richmond Gas Stove and Meter Company, Limited, have received instructions from the Spennymoor and Tudhoe Gas Company, through their Manager and Secretary (Mr. W. Cowley), to furnish complete installations, comprising meter (George Glover and Co.'s make), griller, fittings, material, and labour, in their district. It is anticipated that at least 500 houses will be fitted up.

The attention of gas managers and others interested in maintenance is called by the Wholesale Fittings Company, of 80, Commercial Road, E., to their stock of incandescent arc lamps. One is made of steel, and is strong, well-finished, weather-proof, and constructed to stand hard wear; while it is artistically enamelled in sage green and gold, with white lines. The price will commend itself to all who have the responsibility of advising on the purchase of these important factors in incandescent gas lighting.

The Economic Acetylene Engineering Company, Limited, has been registered with a capital of £1205, in £1 shares, to acquire patents and inventions connected with generators for acetylene and other gases, gas-burners, gas enrichers and purifiers, &c., or for the manufacture of calcium carbide or other substances for the generation of gases; and to carry on the business of engineers, &c. The Empire Acetylene Gas Apparatus Syndicate, Limited, has been registered with a capital of £500, in £1 shares, to acquire all or any of the rights in a British patent (No. 28,439 of 1897) for a new apparatus for producing acetylene gas, and certain improvements in such apparatus made by W. Beach and H. S. Chapman, both of Dover; and to carry on the business of acetylene gas apparatus manufacturers, &c.

In the Chancery Division of the High Court of Justice, Mr. Justice Joyce was occupied last Tuesday and Wednesday with an action in which Messrs. Heine, Solly, and Co. claimed damages from Mr. Spong for alleged fraudulent misrepresentation on the sale of a patent for which he had been paid £100. It related to an automatic pocket gas-lighter; and the plaintiffs said it was invalid by reason of anticipation. The allegation of fraud was founded on the fact that defendant had not disclosed to plaintiffs that prior to the purchase he had arranged with one Pordes to supply him with his lighter, and that therefore he was not the true inventor of the appliance described in his patent. In the result, his Lordship expressed the opinion that the plaintiffs had failed on every ground they relied upon; and he therefore dismissed the action with costs.

The Uxbridge Town Hall was recently the scene of an excellent exhibition, chiefly of gas heating and lighting apparatus, organized by Mr. E. R. Burch, the Engineer of the Uxbridge and Hillingdon Gas Company. Messrs. Fletcher, Russell, and Co. exhibited their bath water-heating apparatus, one pattern of which is so arranged that the gas cannot be turned on unless the water is also being turned on; and Messrs. Thomas Glover and Co., a method of lighting and extinguishing gas by means of an electric bell-push. Among the other exhibits may be mentioned the Hanwell and "Volonta" flexible metallic pendants, the "Gem" candle burners, Wright's gas-heated radiators, Clark's syphon stoves, and Messrs. Falk, Stadelmann, and Co.'s and Messrs. J. & W. B. Smith's fittings. To properly show off the lights, Mr. Burch had a dining-room fitted up and splendidly illuminated; while outside the hall were nine large specimen lamps, and near by a handsome Welsbach lamp. The exhibition was deservedly a distinct success.

In previous issues of the "Journal," we have called attention to the patented rectangular perforated baffle-plate condensers with water-spraying arrangement of Messrs. J. Firth Blakeley and Co., of Dewsbury. Two sets of these condensers were put to work last year—one at Lower Gornal (at the gas-works of the Sedgley Urban District Council) and another at the works of the Ely Gas Company. In addition, the firm have erected a set of six new steel annular condensers for the Alva (N.B.) Gas Commissioners; also a set of four purifiers, 15 feet square and 5 feet deep, with hydraulic travelling lifting apparatus, and one of Weck's patent centre-valves. The firm have put up four 8-feet purifiers at Inverurie, and a new steel 30-feet tank and gasholder, condensers, and scrubber at Doune; and they have at present in hand a washer and 12-feet purifiers for Langholm. They have erected a 50-feet steel tank and gasholder at Emsworth, near Portsmouth; a 40-feet steel tank and double-lift gasholder at Okehampton; 12-feet purifiers at Haverhill; 18-feet purifiers at Woodford; and 10-feet purifiers, with Green's lids, at Oakham. Their combined gas-engines and exhausters have been erected at Dipton (Durham), Miller's Dale, and Yarm; and at the latter place there was also fixed a tower scrubber and automatic washer, &c. They are supplying Cripps' patent washers to Kobe (Japan) and Langholm. They have now in hand a 40-feet double-lift holder and cast-iron tank for the Grange-over-Sands Gas Company; washer, engine, exhauster, scrubber, &c., for Whaley Bridge; 12-feet purifiers for Langholm; and new plant for the County Asylum at Downpatrick, consisting of a steel tank and gasholder, purifiers, three beds of retorts, scrubber, &c.

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DRAUGHTSMAN. Manchester.
WORKING FOREMAN. Croston Gas Department.
MAINTENANCE DEPARTMENT. No. 4292.
GAS FITTERS. Richmond Gas Stove and Meter Company.
MANAGER (AMERICA). No. 4287.
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STOKERS. Swindon Gas-Works.
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Mortgage Bonds. South Shields Gas Company.

Stocks and Shares.

ANDOVER GAS COMPANY. Nov. 21.
BRIDGWATER GAS COMPANY. Nov. 22.
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WANDSWORTH AND PUTNEY GAS COMPANY. Nov. 29.

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Applicants must be Experienced in all Modern Types of Incandescent Burners, Cooking and Heating Stoves, Gas-Engines, &c., and also capable of preparing estimates for fitting up Gas Installations.
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CITY OF SHEFFIELD.

DERWENT VALLEY WATER ACT, 1899.

THE Corporation of Sheffield invite APPLICATIONS from competent Engineers for the Appointment of RESIDENT ENGINEER in the construction of a Tunnel for the purpose of conveying water from the Works of the Derwent Valley Water Board at Ladybower to the Works of the Sheffield Corporation in the Rivelin Valley, a total length of nearly Five Miles, of which a length of about 1700 yards has already been driven.
The gentleman appointed will be required to reside in the immediate vicinity of the Tunnel works, and to devote the whole of his time to his duties under the Corporation. He will have daily personal charge of the work, and be responsible for it throughout; and will perform all special work and duties in connection therewith which the Water Committee of the Corporation may desire. The staff of Assistants, Inspectors, and others is provided by the Corporation, and will be under the direction of the Engineer.
The Engineer will be required to confer with the Consulting Engineer with regard to all plans and designs, and at every step during the progress of the works, but without thereby lessening his own absolute responsibility; and he shall report direct to the Water Committee, from whom alone he will take instructions.
It is indispensable that candidates for the appointment should have had considerable experience both in the design and carrying out of similar works, either under a contractor or by administration under a public authority.
Applicants must state Age, Experience, present Position, Salary required, when at Liberty, and forward *copies* of Testimonials, and the names of Two References. Personal canvassing will be a disqualification.
Applications to be sent to me not later than Monday, the 28th day of November inst., endorsed "Rivelin Tunnel Engineer."
By order,
Henry Sayer,
Town Clerk.
Town Hall, Sheffield, Nov. 9, 1904.

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WANTED, immediately, in a Suburban Gas-Works, Two LEADING STOKERS; and one SECOND HAND. Must be not less than 5 ft. 10 in. in height. Twelve-hour shifts. Wages: Leaders, 36s. per week; Second, 32s.
Apply, by letter, enclosing Testimonials, to No. 4294, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.
J. F. Blakeley, Gas Engineer, Thornhill, Dewsbury.

FOR SALE—Ninety Tons of 8-inch and 6-inch Gas-Mains, in first-class condition. One Walker Scrubber-Washer. 7 feet Pan Mortar-Mill. Three Cornish Boilers, each 12 feet by 5 feet for 60 lbs. pressure. Vertical Boilers from 10 feet by 4 feet down to 6 feet by 2 feet 6 inches. Horizontal and Vertical Steam-Engines, all sizes. Inquiries solicited. Geo. Dean, Foley, Longton, Staffs.

NOTICE—VALUABLE PATENTS FOR DISPOSAL.

THE Inventions enumerated below are valuable and worthy of the careful attention of all firms who desire to keep pace with the times with their plant. The Patent Rights are either for Sale outright, or may be worked on Licence, or we will on reasonable terms agree for them to be manufactured and supplied by a Company to be formed for that purpose.
WASHER-SCRUBBER.—The design of a new rotary Washer-Scrubber on the principle of the honeycomb cell. It has a larger scrubbing surface than anything yet produced, and is free from binding friction against the drive. It also embodies many other advantages necessary in a successful Washer-Scrubber.
PRIMARY CLEANSER.—A most perfect device arranged so as to arrest the greater part of the heavy impurities in crude gas before being conducted through any other purifying device, thereby lessening the task of such apparatus, consequently giving them a much longer period of action.
NOTE—We are prepared to supply this Primary Cleanser without direct charge, taking payment by results in savings over an agreed period.
HYDRAULIC MAIN VALVE.—A simple arrangement, all comprised in one Valve, in which the seals to dip pipes are regulated as to depth or removed, and also, when required, acts as a complete double-faced Stop Valve. All these manipulations are made with one movement and with but one moving part.
NEW FOUR-WAY VALVE.—This one Valve is capable of performing the following functions: Complete Double-Faced Stop, reverse motion, and also Bye-Pass, all combined and working with but one moving part. It is applicable to reverse any single or combination of apparatus.
CENTRE VALVE.—This Valve enables one to have all his Four Purifiers in work, and at any time to cut out for changing, and immediately to put into action again. It will also, with the addition of one of the above Four-Way Valves, enable you to reverse the whole bed of Purifiers, thereby ensuring greater duty from the purifying material.
PURIFIERS.—With new methods of revification *in situ*, and otherwise, also new methods of discharging, a new Grid and Grid Bar, which secures an increased surface contact, even density, and increased capacity. With the combination of the above, a Purifier may be put through the whole cycle of operations of changing well within one-tenth part of the time of present practice, and with but a fraction of the labour hitherto required, and that without endangering either life or health. The above systems adapt themselves equally well to Tower Purifiers as advanced by eminent engineers in the United States and the British gas publications of recent dates. With these arrangements we can surpass anything now on the market for quantity of material in space, greatest utility, and the highest attainable working results.
We intend to be in attendance with Models and Drawings of the above, at a convenient address near to Earl's Court, during the latter period of the Exhibition, and meantime invite all interested parties to communicate with us as below, when we shall be pleased to arrange an appointment to inspect same with a view to business.
T. Redman & Co.
The Priory, Bradford.

NEW Gasholder, 40 ft. diameter by 12 ft. deep, with Steel Standards; also new STEEL TANK to contain same.
Write J. Wright, 181, Queen Victoria Street, London, E.C.

"DEMPSTER'S" Direct-Acting Re- ciprocating Pumps, Exhausters, and Steam-Engine Combined. Two Sets, 8-inch and 12-inch Connections. Overhauled and Guaranteed. Cheap. Room wanted.
Firth Blakeley & Co., Gas Engineers, Dewsbury.

THE Frome Gas Company have for dis- posal the following Second-Hand Plant, which has been removed to make room for larger.
Two Table ENGINES, 6½-inch Cylinders by 12-inch Stroke.
One 16-inch EXHAUSTER (10,000 feet per hour).
One 8-inch FOUR-WAY BYE-PASS VALVE.
Three 8-inch SLIDE VALVES.
One 8-inch S. A. BYE-PASS VALVE.
Prices and all Particulars on application to the Manager, Mr. H. F. Vincent, at the Gas-Works, Frome.

TO WATER-WORKS MANAGERS AND OTHERS.

FOR SALE—A Horizontal Condensing PUMPING-ENGINE, steaming at about 60 lbs., with jacketted Cylinder and Well and High Lift Pumps complete, capable of raising water from a well of 100 feet in depth, and raising the same 250 feet above ground level at the rate of 35,000 gallons per hour.
The Engine is in thorough working order, and may be seen at any time during the next four weeks, after which it will be dismantled to make room for a larger engine.
The price, as it stands, complete, £400.
Apply to Messrs. John Taylor, Sons, and Santo Crimp, Civil Engineers, 27, Great George Street, Westminster, from whom full Particulars may be obtained.

URBAN DISTRICT OF BANGOR, CO. DOWN
(Gas Department.)

TENDERS are invited for the supply of DRY METERS—Ordinary and Prepayment—for One Year from Jan. 1, 1905.
Meters to be delivered to our Stores in good order and carriage paid.
Further Particulars can be had, if required, from the Gas Manager, Mr. B. Mitchell.
Tenders, endorsed "Tender for Meters," must be delivered at my Office, not later than Tuesday, Dec. 20, 1904.
The lowest or any Tender not necessarily accepted.
James Milliken,
Town Clerk.

WILMSLOW AND ALDERLEY EDGE GAS COMPANY.

THE Directors of the above Company invite TENDERS for the supply of WROUGHT-IRON TUBES and FITTINGS, COMPO. and LEAD PIPE, and BRASS FITTINGS required during the ensuing Twelve Months.
Sealed Tenders, endorsed "Fittings," to be addressed to Mr. W. H. Welsh, Secretary, 52, Brown Street, Manchester, and delivered not later than Tuesday, the 22nd of November, 1904.
Forms of Tender and any other Information may be had from the undersigned.
Wm. Severs,
Engineer and Manager.
Gas-Works, Wilmslow,
Nov. 5, 1904.

COUNTY BOROUGH OF SALFORD.
(Gas Department.)

THE Gas Committee invite Tenders for the supply of about 1700 Tons of SULPHURIC ACID, to be delivered during the Year 1905.
Full Particulars may be obtained on application to Mr. W. W. Woodward, Engineer, Gas Offices, Bloom Street, Salford.
Sealed Tenders, endorsed "Tender for Acid," addressed to the Chairman of the Gas Committee, to be delivered to me not later than Three p.m. on Thursday, the 24th of November, 1904.
L. C. Evans,
Town Clerk.
Town Hall, Salford, Nov. 9, 1904.

ALDERSHOT GAS AND WATER COMPANY.

SURPLUS TAR.

THE Directors are prepared to receive and consider TENDERS for the purchase of surplus TAR (approximately 1800 Tons) produced at their Gas-Works, Ash Road, Aldershot, (private siding into Works, Tongham Station, L. & S. W. Rly.), for a Year from Jan. 1 to Dec. 31, 1905.
Specifications and Conditions can be obtained on application to the undersigned.
Tenders to be sent in to the undersigned, endorsed "Surplus Tar," to arrive not later than nine o'clock on the morning of Friday, Dec. 2, 1904.
The highest or any Tender not necessarily accepted.
By order,
R. W. Edwards,
Secretary.
Nov. 8, 1904.

SOUTH SHIELDS GAS COMPANY.

ISSUE OF 3¾ PER CENT. MORTGAGE BONDS.

THE Directors are prepared to receive APPLICATIONS for MORTGAGE BONDS at the above Rate, less Income-Tax, in multiples of £100, for a term of not less than Three Years, repayable at any time after that period by a Six Month's Notice on either side.
Interest payable Half-Yearly, on the 30th of June and 31st of December in each Year.
J. H. Penney,
Secretary.
Gas Offices, Chapter Row,
South Shields, September, 1904.

ISSUES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MR. ALFRED RICHARDS begs to notify that his ISSUES by AUCTION under PARLIAMENTARY POWERS of STOCKS and SHARES in LONDON, SUBURBAN, and PROVINCIAL GAS and WATER COMPANIES take place PERIODICALLY at the Mart, TOKENHOUSE YARD, E.C.

Terms for Issuing such Capital, and also for including Gas and Water Stocks and Shares belonging to Private Owners in these Periodical Sales, can be obtained on application at MR. ALFRED RICHARDS' OFFICES 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
WANDSWORTH AND PUTNEY GASLIGHT AND COKE COMPANY.

NEW ISSUE OF £10,000 ORDINARY "C" STOCK, ranking for a Standard Dividend of 3½ per cent., subject to the Sliding-Scale, the last Dividend on the Company's existing "C" Stock having been at the rate of £5 8s. 6d. per cent. per annum.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION at the Mart, Tokenhouse Yard, E.C., on Tuesday, Nov. 29, at Two o'clock, in Lots of £100, £50, and £25 each.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
SOUTH ESSEX WATER-WORKS COMPANY.

NEW ISSUE OF £5000 FOUR PER CENT. PERPETUAL DEBENTURE STOCK AND £5000 ORDINARY STOCK.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Monday, Dec. 5, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

ANDOVER GAS AND COKE COMPANY, LIMITED.

A HIGH-CLASS LOCAL INDUSTRIAL INVESTMENT.

Notice of Sale of 185 Shares of £10 each in the above prosperous undertaking, which has for the past 10 Years paid a dividend of £10 per cent. per annum.

MESSRS. FREDERICK ELLEN and SON will SELL THE ABOVE BY AUCTION, at the Mart, Andover, on Monday, the 21st of November, 1904, at Three o'clock in the afternoon.

The above Shares are the remaining unissued portion of the New Stock authorized for the enlargement of the works and installation of improved manufacturing plant, rendered necessary by the steady and continuous increase in the Company's Business, *which works have now been completed.*

Particulars and Conditions of Sale may be had of Messrs. LAMB AND SON, Solicitors, ANDOVER; or the AUCTIONEERS, The Mart, ANDOVER.

BRIDGWATER GASLIGHT COMPANY.

SALE BY AUCTION OF £5000 NEW STOCK "C."

THE above Company will offer for Sale BY AUCTION, in convenient Lots, at the Clarence Hotel, Bridgwater, £5000 NEW STOCK "C," on Tuesday, Nov. 22, 1904, at Three p.m. precisely.

This Stock forms a portion of the Additional Capital authorized to be raised by the Bridgwater Gas Act, 1903. It will rank for Dividend in equal proportion with the £18,000 of Original Stock "A," and with the £24,000 of Improvement Stock "B" of the Company, and will be entitled to the standard rate of Dividend of 5 per cent. per annum, with gas at 3s. 6d. per 1000 cubic feet, with ¼ per cent. rise or fall in Dividend for every 1d. per 1000 rise or fall in the price of gas. The present price of gas is 3s. per 1000 cubic feet, and a reduction to 2s. 10d. is to be made in Jan. next. Dividends are paid half-yearly—viz., March and October.

The present subscribed Capital of the Company is £42,000; and the amount authorized is £84,000, with £28,000 Additional Loan Capital.

The sale of gas during the last Ten Years has Increased from 45 Million cubic feet to 66 Millions.

Further Particulars may be had on application to J. H. CORNISH, Secretary and Manager, or J. W. MANCHIP AND SON, Auctioneers, BRIDGEWATER, or BARHAM AND SON, Solicitors, BRIDGWATER.

Now Ready, Price 15s., Limp Cloth.

TWENTY-FOURTH YEAR.

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OF THE

METROPOLITAN WATER COMPANIES

(Chelsea, East London, Grand Junction, Kent, Lambeth, New River, Southwark and Vauxhall, and West Middlesex),

AND OF THE

ACCOUNTS OF SOME OF THE PRINCIPAL

PROVINCIAL WATER UNDERTAKINGS

FOR THE YEAR 1903-1904.

Compiled by

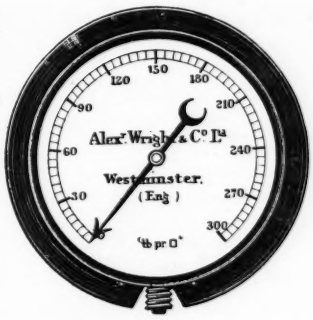
WOOD, DREW, & CO.,

Chartered Accountants.

LONDON:

WALTER KING, 11, Bolt Court, FLEET STREET, E.C.

STEAM, OIL, and WATER.



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Ninth Edition, Revised, with Notices of Recent Improvements.

By HENRY O'CONNOR, A.M.Inst.C.E.,

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SOMETHING NEW.

Mr. Micawber expected something good to turn up.

IT HAS.

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Ducal Hall, Earl's Court.

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IMPERIAL STOVE COMPANY, LEAMINGTON.

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New and Second-Hand with all Accessories; also Tip Waggons and Turntables.

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Best Gas Coal and Cannel, giving High Illuminating Power, Large Yield per ton, and reasonable in Price.

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Rich in Illuminating Power and yield of Gas.

Above the Average in Weight and Quality of Coke.

Maintains a High Standard in Residuals.

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JAMES OAKES & CO.,

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Manufacture and keep in Stock at their Works (also large stock in London)

PIPES and CONNECTIONS, 1½ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS, and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with Bolts, Nuts, and Covers, and rendering Leakage impossible.

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INCANDESCENT GAS LAMP.

The only Lamp with absolutely **DUST AND INSECT PROOF BURNER.**

MANY DETAIL IMPROVEMENTS.

This Burner being positively Dust and Draught Proof, it prolongs the life of the Mantle and Saves its Cost in Maintenance.

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THE
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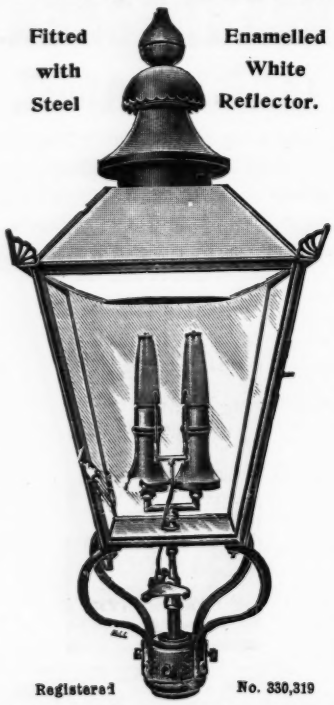
"KILBURN" LANTERN.

Fitted with Steel

Enamelled White Reflector.



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effects a great saving of time, labour, and expense.

For Particulars, Price, &c., apply to **Mr. EDWARD PRICE,** "Langley," Wyke Avenue, **WORTHING.**

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MIRFIELD GAS COAL
UNEQUALLED.
Sperm Value 878·85 lbs. per Ton.

Prices and Analysis on application.
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THE SILICA FIRE-BRICK COMPANY,
OUGHTIBRIDGE, near SHEFFIELD,
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SILICA BLOCKS, BRICKS, AND CEMENT
OF SUPERIOR QUALITY
FOR GAS-FURNACES.
Trade Mark: "SILICA."
These Goods (largely used in Gas, Glass, Iron, and Steel Works) are, on account of their
GREATER DURABILITY,
Strongly recommended where EXCESSIVE HEATS have to be maintained.

THOMAS TURTON AND SONS, LIMITED,
SHEAF WORKS, SHEFFIELD,
MANUFACTURERS OF
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FOR ENGINEERS.
STEEL OF ALL DESCRIPTIONS.
SCREW STOCKS, TAPS AND DIES, SPANNERS, RATCHET BRACES, LIFTING JACKS, ANVILS, VICES, AND ENGINEERS' TOOLS GENERALLY.
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WATERINE.
REGISTERED.

The most powerful and efficient but withal absolutely harmless Water Softener and Purifier.

Descriptive Pamphlet and Prices on application to
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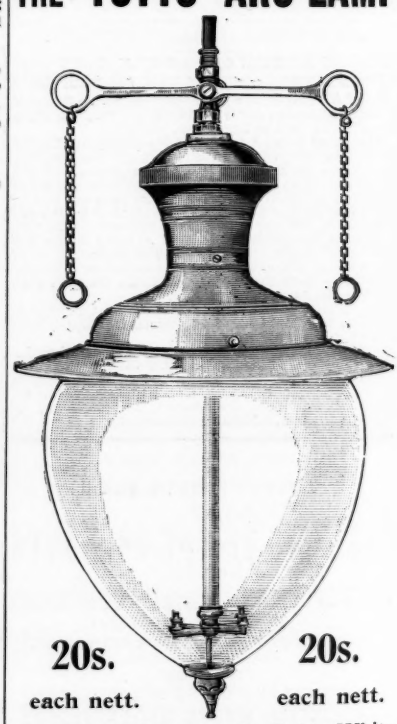

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In almost every department additions have been made; and it is believed that the labour bestowed on its production will enhance the value of the book as a Work of Reference.

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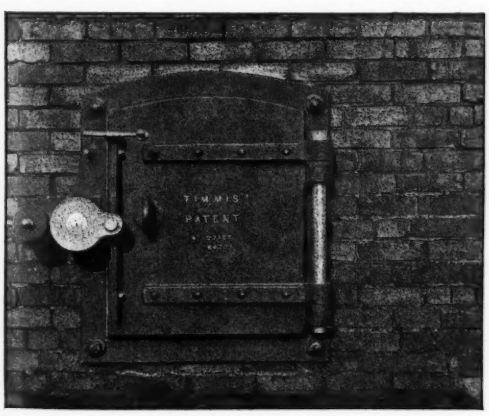
TIMMIS'S PATENT CLINKERING DOOR.

It is a well-known fact that the ordinary Clinkering Door which is fastened only at the middle almost invariably warps with the heat, thereby **admitting primary air in unknown quantities and in the wrong place.** Where two fastenings are used to either single or double doors it is impossible to apply equal pressure with them, and as a rule only one of them is used, the results being worse than with the single fastening. With Timmis's Patent it is impossible to avoid putting equal pressure on both top and bottom, and with the same ease as with the old single fastening.



Advantages.

1. It renders **warping impossible.**
2. **No primary air** can pass into the furnace **between the Door and the Frame.**
3. It is **the only Clinkering Door** that can be **sealed top and bottom by the operation of one fastener.**
4. There are **no complicated parts** to wear or get out of order.
5. **Double Doors** can be **dispensed with.**
6. It occupies **no more room than the ordinary door.**

DESCRIPTION OF DOOR.

TIMMIS'S PATENT CLINKERING DOOR is fastened by means of a vertical bar pivoted in the centre and provided with a screw at the top end. When the screw is tightened, the lower end of the bar is pressed with equal force against the lower corner of the door. **The two corners are therefore subject to equal pressure and warping is impossible.** To release the door the screw is loosened, and the bar, which is balanced by a counter-weight and rotates upon a strong pin attached to the frame, is moved clear of the door. The sketch above shows the position of the bar when the door is closed.

Further Particulars and Prices on Application to the Patentee:

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WILL BE OPENED BY THE

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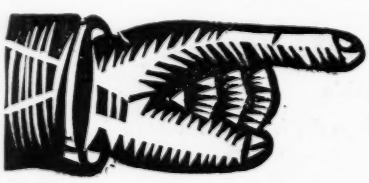
On Saturday Next, November 19,

AND WILL REMAIN OPEN UNTIL

SATURDAY, DECEMBER 17.



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'RUBY'

GAS MANTLE.

UNRIVALLED IN DURABILITY.

UNIQUE IN QUALITY.

5000 Hours. DEMAND SAMPLES. 5000 Hours.

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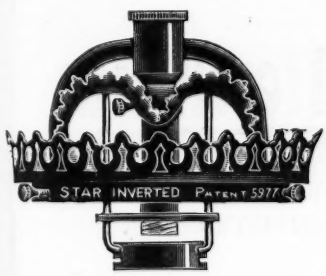
(PATENT 5977—1903)

INVERTED BURNERS



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Refuse to accept Imitations and avoid Litigation.

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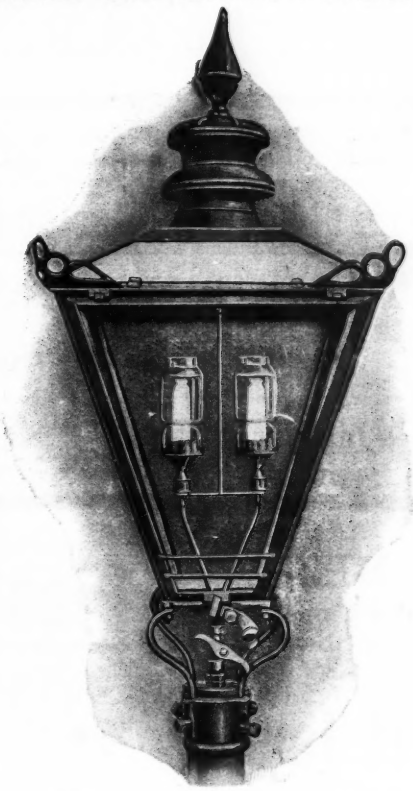
For Incandescent Street Lighting.

ALL COPPER.

WIND AND RAIN PROOF.



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Enamelled Earthenware Reflector, "Bray" C. Burners and Anti-Vibrating Frame.

These Lanterns are made in several Designs and Sizes.

New Season's Catalogue ready shortly.

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GAS LIGHTING ENGINEERS,

BAGBY WORKS, LEEDS.

THIS TALKS!!!

We have Lighted a Section of Plymouth Docks
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An Extension has been Ordered.

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The Council has unanimously decided that we be requested to do the whole of the Public Lighting.

We are

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70	,,	Electric Arc.
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It is the LAST WORD.

THE MILLENNIUM SYSTEM IS A METHOD OF COMPRESSING ORDINARY GAS. . . . .

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The British Compressed Gas Co., Ld.,

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ANTI-VIBRATION INCANDESCENT LIGHTING CO., LD.,

35, KIRKSTALL ROAD, LEEDS,

Will be pleased to see you at their

STAND Nos. 68/103,

At the International Gas Exhibition, Earl's Court, W., Nov. 19 to Dec. 17.

Anti-Vibrators for all purposes. **DO NOT FAIL TO GIVE US A CALL.**

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WROUGHT-IRON TUBES & FITTINGS for GAS, WATER, & STEAM.
BRASS GAS-FITTINGS, GAS-VALVES, STEAM & WATER VALVES, TOOLS, &c., AND OF
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LONDON: LAMBETH BRASS & IRON CO., LTD., 91 & 93, SOUTHWARK ST., S.E.

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Are exclusive Owners of the well-known HAIGH HALL & KIRKLESS HALL GAS COAL COLLIERIES, and supply the Best Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, Cannel Nuts, &c.

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MAINTENANCE SIMPLIFIED.

Nothing to Corrode. Nothing to Choke.
Nothing to get out of Order.

Made in 4 Sizes consuming 3, 4, 4½, and 6½ feet. In Brass or Nickelled.

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ALDWARKE MAIN, CAR HOUSE, & ROTHERHAM MAIN COLLIERIES, NEAR ROTHERHAM.

ALDWARKE MAIN GAS COAL

Analysis: 12,600 Feet of 19-Candle Gas per Ton.
Value in Pounds of Sperm, 820·20.

VERY FREE FROM IMPURITIES.

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GREATEST ECONOMY.

THE DELLWIK-FLEISCHER WATER GAS PROCESS.
PATENTS IN ALL COUNTRIES.
BLUE WATER GAS, CARBURETTED WATER GAS.

COMBINED WITH
SELF-CARBURETTING
AT

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Suitable for Incandescent or Ordinary Burners.

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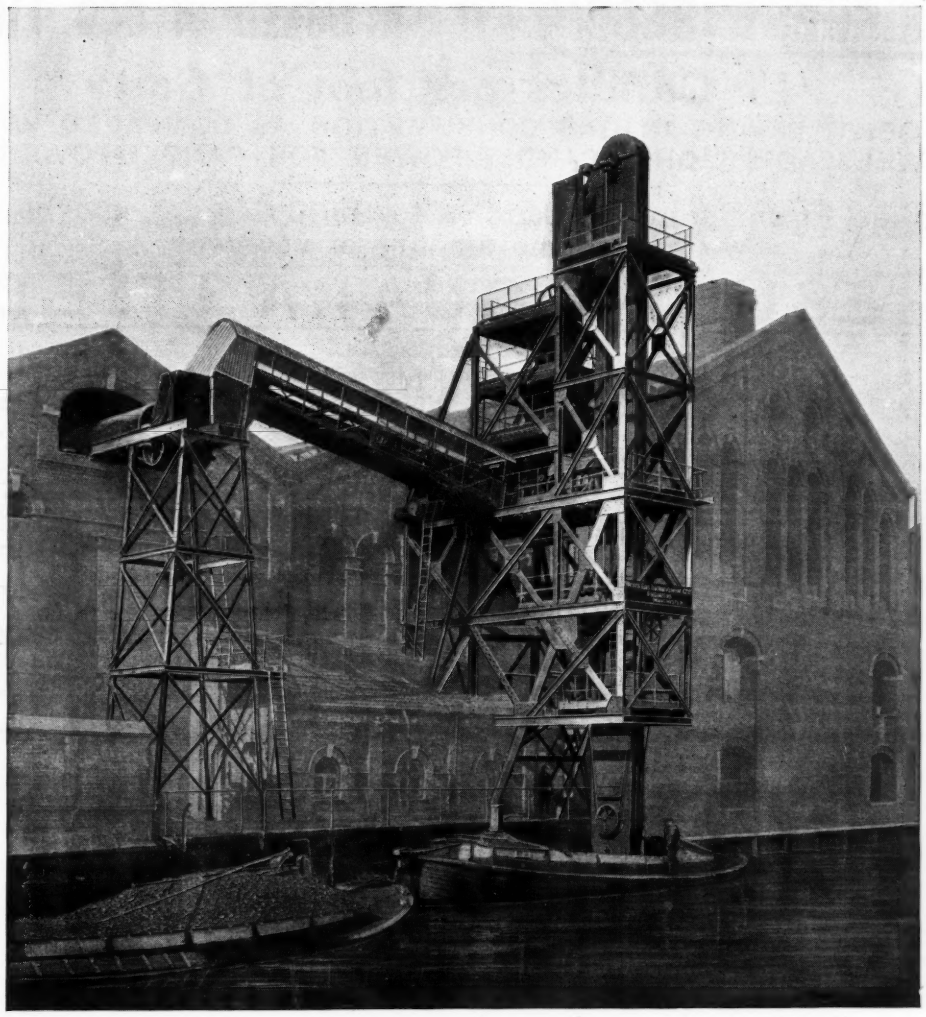

PHOTOGRAPH SHOWING

West's Coal Handling Plant for unloading Barges, Elevating, Breaking Automatic Weighing, Conveying, and Storing the Coal in Stores.

STOKING MACHINERY SPECIALISTS

Over 140 Installations of West's Stoking Machinery now at work.

West's Patent Coke-Conveyors.
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Compressed Air and Gas, Consumption of Gas Reduced to a Minimum.

THE HIGHEST RESULT YET ATTAINED IN GAS LIGHTING.

45 Candles per foot of Gas.

50 PER CENT. SAVING IN GAS CONSUMPTION AS COMPARED WITH THE WELSBACH LIGHT, CANDLE-POWER FOR CANDLE-POWER.

Any Candle Power, from 30-Candles to 2500-Candles, can be obtained with the same amount of economy.

RESULTS GUARANTEED.

TESTIMONIAL. *May 11th, 1904.*

The economy in gas used in the workroom and warehouse, comparing the quarters ending March, 1903, with March, 1904, was as follows:

Gas Account, March, 1903	£12 11 8
,, ,, March, 1904 (Selas)	3 16 3
Saving	£8 15 5

Besides the economy in the gas consumption, the purity and coolness of the atmosphere is even of greater importance. Previously to the installation our people suffered headaches, although the workshops are well ventilated; but under the "Selas" plan, the workpeople have enjoyed better health, and better work is produced. After six months trial of the "Selas" light, we feel sure that its merits will ensure it a permanent success.

We shall be pleased to answer any inquiries, and you are at liberty to publish these results.

(Signed) NICHOLSON & CO., Cloth Proofing Works, ST. ALBANS, HERTS.

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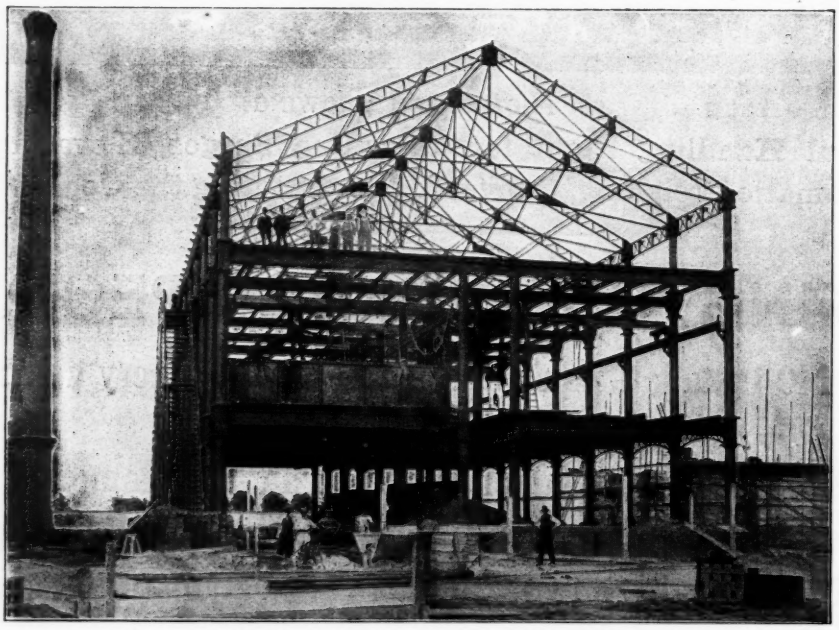
Works: DARLINGTON.

MAKERS OF EVERY DESCRIPTION OF GAS PLANT.



GASHOLDERS AND DRY-SEAL PURIFIERS A SPECIALITY.

PHOTO. OF STAGE-FLOOR PURIFIER-HOUSE TAKEN DURING ERECTION FOR THE UNION DES GAZ AT THEIR WORKS NANTERRE, PARIS.

London Office: 106, CANNON STREET, E.C.

THE ORIGINAL NEW INVERTED INCANDESCENT GAS-BURNERS

BRITISH MANUFACTURE.

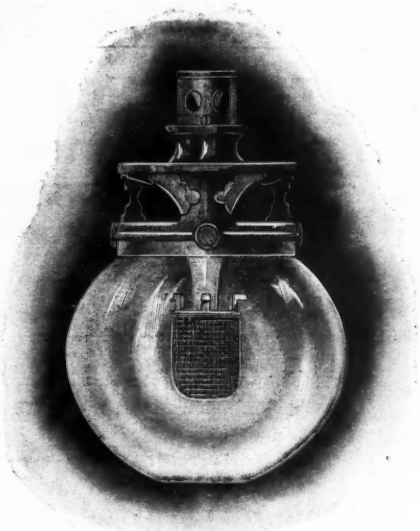
INCREASED DISCOUNTS TO THE TRADE.

New types of BURNERS at popular Prices.

MAXIMUM LIGHT WITH MINIMUM CONSUMPTION OF GAS.

The "Bijou" Burner in clusters for interior lighting has the decorative effect of Electric light at One-Eighth the cost.

NEW LISTS NOW READY.



No. 2 Burner only, in Polished Brass or Steel Bronze, 4s. 6d. Globes from 6d. each. Mantles 7s. per dozen.

No. 3 "Bijou" Burner only, in Polished Brass or Steel Bronze, 3s. Globes from 4d. each. Mantles 6s. 6d. per dozen.

ONLY ADDRESS: THE NEW INVERTED INCANDESCENT GAS LAMP CO., LD.,

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We shall be Exhibiting at the International Gas Exhibition, Earl's Court, W., Nov. 19 to Dec. 17, at STAND No. 60. A visit will be esteemed.

JÄGER'S PATENT GRIDS

APPLICABLE TO EVERY KIND OF PURIFIER.

This System is in successful operation at a very large number of important Gas-Works on the Continent, and orders have been received from English Engineers as follows:—

			ft.		ft.		ft.	in.
CHESTER	1	Purifier	24	×	22	×	5	3
CHESTER 2nd Order	1	,,	24	×	22	×	5	3
ROCHESTER	4	,,	20	×	20	×	5	6
ROCHESTER 2nd Order	2	,,	24	×	20	×	5	0
SOUTHEND	2	,,	20	×	15	×	4	6
HULL	2	,,	20	×	20	×	5	0
BRENTFORD	1	,,	20	×	30	×	7	0
WINCHESTER	4	,,	15	×	15	×	6	0
CAGLIARI	4	,,	10	×	10	×	4	0
HALSTEAD	4	,,	9	×	9	×	5	0
DEAL	1	,,	10	×	10	×	4	6
LEAMINGTON	1	,,	20	×	20	×	5	0
OLDHAM	4	,,	20	×	20	×	4	0

Full Particulars, Estimates, Models, and Records on application to Sole Licensees and Manufacturers:

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Patent Automatic Machinery
FOR
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Full Particulars may be obtained from the Sole Makers.
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[See Illustrated Advertisement, Nov. 1, p. 366.]

MOBBERLEY & PERRY
Stourbridge,
Are being entrusted with **LARGE REPEAT ORDERS** for Home and Abroad for INCLINED and HORIZONTAL RETORTS
CONSEQUENT UPON THE "A1" QUALITY THEY SUPPLY.
Do not fail to visit our Stand No. 158 at the International Gas Exhibition, Earl's Court, W., Nov. 19 to Dec. 17.

1 Cubic Metre of Gas per 0·5 Kilogramme of Coke!
Both Oil-Carburetted & Benzol-Carburetted Water Gas in the same Generator.

CARBURETTED
WATER-GAS PLANT
(STRACHE SYSTEM).

For Prices and full Particulars, apply to the

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MANUFACTURERS OF
BEST FIRE-BRICKS; INCLINED, HORIZONTAL, and SECTIONAL RETORTS; LUMPS, TILES, &c., of every description.
ESTABLISHED 1860.

CLAYTON SON & Co Ltd LEEDS
MAKERS OF THE LARGEST GASHOLDER IN THE WORLD ALSO
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SPIRAL GUIDED GASHOLDERS
MAKERS OF ALL KINDS OF STRUCTURAL IRON & STEEL WORK. STEEL FRAMED BUILDINGS ROOFS RETORT FITTINGS PURIFIERS RETORT LIDS ANTIFREEZERS for Gasholders
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OF EVERY DESCRIPTION & SIZE
HIGH CLASS BOILERS FITTED WITH CORRUGATED FLUES.
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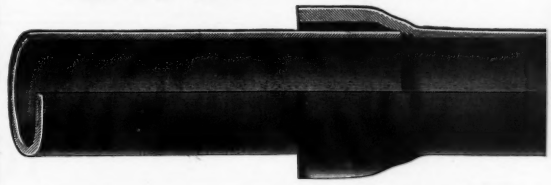

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In any Length up to 40 feet for
GAS & WATER MAINS.
A PERFECT SUBSTITUTE FOR CAST-IRON MAINS.
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SAFETY. REMEMBER. ECONOMY.
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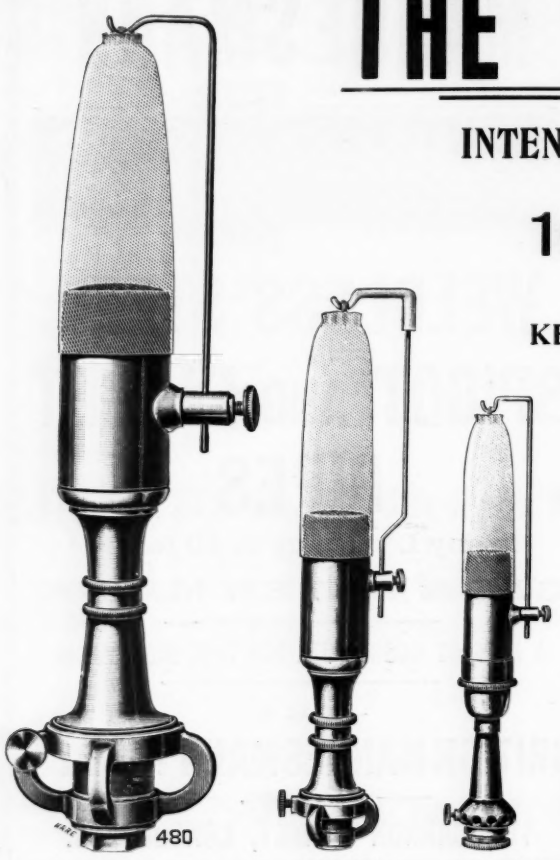
DEMPSTER'S IMPROVED PATENT SPIRAL GUIDED GASHOLDERS.
AVOID COLOURABLE IMITATIONS AND INSIST UPON HAVING PATENT SPIRAL PLATES.
MANY REPEAT ORDERS.
THESE PERFECTED SPIRAL GASHOLDERS HAVE STOOD ALL TESTS, & ARE THE SAFEST GASHOLDERS IN THE WORLD. GUIDES & ROLLERS ALWAYS ACCESSIBLE.
"YOUR SPIRAL HOLDER STANDS LIKE A ROCK."
R. & J. DEMPSTER, LTD., MANCHESTER.

THE KEITH LIGHT.



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INTENSIFIED INCANDESCENT GAS.

1600 INSTALLATIONS NOW IN USE.

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MAINTAINED AT A MINIMUM COST.

Perfect Air-inlet Adjustment.

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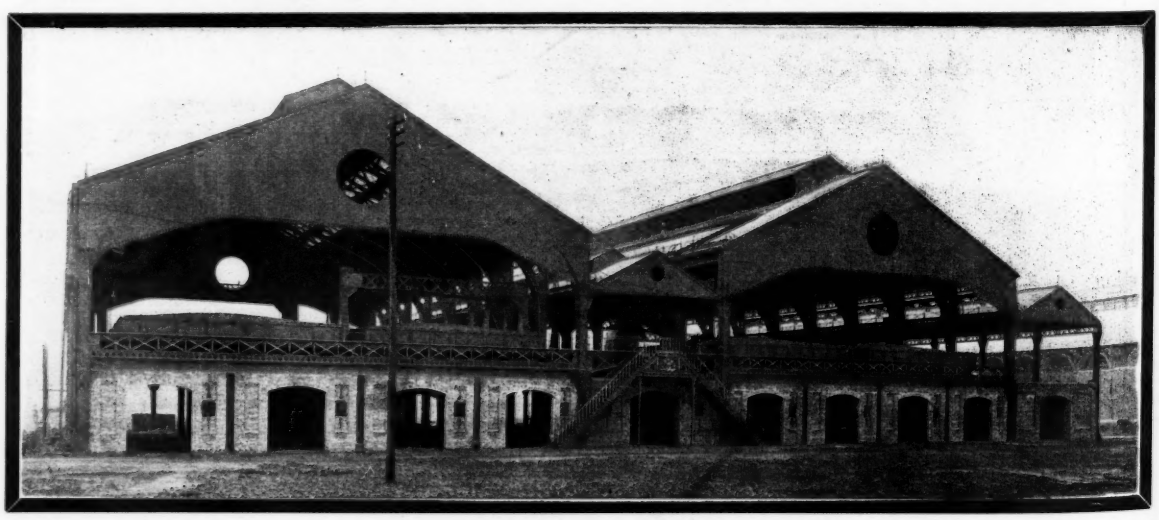
SOLE MAKERS OF

THE "ECLIPSE" SPECIALTIES

IN WASHER-SCRUBBER, WATER-TUBE CONDENSERS, AND DRY-LUTE PURIFIERS.



The above is a view of a Purifying Plant entirely undertaken by us, it covers 4444 square yards and contains Twelve Purifiers with space for an additional Four, each 35 feet square, with a total area of 14,700 square feet. Upwards of 2490 Tons of Steel and Iron were used.

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